

# Aviation Week

*and Space Technology*

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January 15, 1962

**GE Investigates  
VTOL Concepts**

*Nike Zeus Launching  
At Pt. Mugu*



SONIC FATIGUE  
SONIC FATIGUE  
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SONIC FATIGUE



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## moon

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## AEROSPACE CALENDAR

(Continued from page 1)

- Feb. 14-16—International Solid State Conference, University of Illinois, Urbana, Ill.
- Feb. 21-23—Golden Gate Space Conference, American Society for Metals, Tuxedo Hotel, San Francisco, Calif.
- Feb. 19-23—Tracking & Control of Aerospace Vehicles, Institute of the Aerospace Sciences, San Francisco, Calif.
- Feb. 22—First Women's Space Symposium, Anderson Hotel, Los Angeles, Calif.
- Feb. 27-Mar. 1—Third Annual Symposium on Nondestructive Testing of Aircraft and Missile Components, Lockheed, Convair Hotel, San Antonio, Tex. Sponsored by South Texas Section Society for Nondestructive Testing, Southwest Research Institute.
- Feb. 27-Mar. 1—Symposium on the Application of Buckling Theory in Space Technology, Palo Alto, Calif. Sponsored by Lockheed Aircraft Corp., Air Force Office of Scientific Research.
- Mar. 1-5—Sixth Satellite and Sensor Detector Systems Symposium (IEEE), Sheraton Hotel, Washington, D.C.
- Mar. 14—Sixth Annual Gas Turbine Conference and Products Show, American Society of Mechanical Engineers, Sheraton Hilton Hotel, Houston, Tex.
- Mar. 8-9—Symposium of the Aerospace Society, Provisional Meeting (closed), Cleveland, Ohio.
- Mar. 14-16—Electronic Propulsion Conference, American Rocket Society, Hotel Cleveland, St. Louis, Mo.
- Mar. 18—General Robert H. Goddard Memorial Symposium, Engineers and Architects Society in Seattle, American Astronautical Society, Washington.
- Mar. 20-21—International Convention in State of Radio Engineers, Coleman and Waldorf Astors, New York.
- Mar. 20-21—Third Symposium on Engineering Aspects of Magnetohydrodynamics, University of Rochester, Rochester, N.Y. American Astronautical Society of Electrical Engineers, Institute of the Aerospace Sciences, Institute of Radio Engineers, University of Rochester.
- Apr. 1-4—Mid Year Conference, Airport Conference Council, Sheraton Hotel, Washington, D.C.
- Apr. 1-4—Launch Vehicles Symposium and Materials Conference, American Rocket Society, Sheraton Hotel, Phoenix, Ariz.
- Apr. 1-4—National Aerospace Meeting including production forum, Society of Automotive Engineers, Hotel Commodore, New York, N.Y.
- Apr. 10-12—Second Symposium on The Plasma Shield—An Effect Upon Radio Communications and Detection, New England Virtual High School, American AP, Cambridge, Research Laboratories.
- Apr. 12-14—Aeronautical Conference and Electronics Show, Institute of Radio Engineers, Ritz Hotel, Houston, Tex.
- Apr. 12-14—Annual Technical Meeting and Engineering Exposition, Institute of Environmental Sciences, Sheraton Towers Hotel, Chicago, Ill.
- Apr. 14-16—Second Conference on Kinetics, (Continued on page 9)

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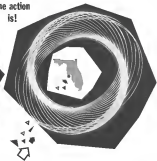
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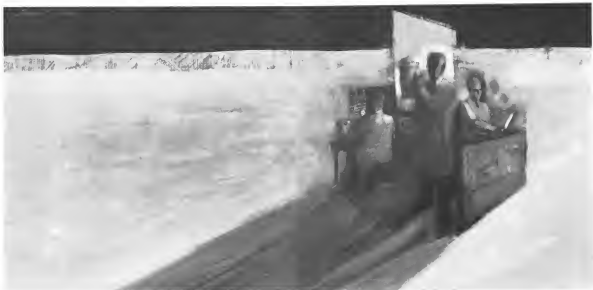
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Since its earliest days, America's aviation industry recognized the significance and need for extensive research activities. Today the aviation industry is better known as

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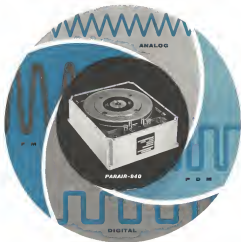
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► Single launch vehicle to carry five separate units, experiments require orbits reaching high latitudes

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► Tilted against disclosure merger discussion during pre-trial deposition hearings in TWA suit against Hughes

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► Byen reserves contract for full-sized flight vehicle, series based on requirements of U. S. services and NATO

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## EDITORIAL

### Space Pace Accelerates

As we predicted about this time last year (AVF Jan 16, p 23) the pace of the U.S. space program has been accelerated significantly during 1961. President Kennedy's establishment last spring of manned space flight to the moon as a national goal gave the program a good long-range focal point around which to develop the broad spectrum of space technology that action needs to see travel both in this country and abroad we find there is still a basic public misunderstanding regarding the significance of the lunar landing program, although we are sure the Soviet space scientists grasp its full import accurately. Too many people regard the lunar landings either as a spectacular stunt or as the end product of our space program. If either of these two views were valid the Apollo program would not be worth the price we will pay for it, either in taxpayer dollars or in the time and energy expended by our best scientific and engineering brains.

#### Program Focal Point

Fortunately, neither of these views is valid. The moon program, with its high national priority, is simply a focal point around which to develop effectively the broad base of space technology that is necessary for our economic, military, and international prestige requirements as a nation. Once past the initial manned orbital flights, the moon is the next logical goal of manned exploration. As such, it is probably the best nucleus around which to organize an expanded, accelerated, and technologically aggressive space program.

To land men on the moon, permit them to explore it and return safely to earth, it will be necessary to fill virtually all of the current voids in scientific knowledge about the frontiers of space technology. It will also be necessary to design and construct all types of space vehicles that will be required for both civil and military operations in space and to perfect operational techniques for virtually all of them. This is particularly true for the key technologies of orbital rendezvous and high velocity controlled reentry, for mastery of both must be achieved before an individual expedition of manned space flight is possible beyond low orbit.

We respectfully suggest to the layperson officials of NASA that they devote considerable time and effort this year to local, effective explanation to both Congress and the American people of the full technical and economic significance of the Apollo program. If they do it, they

can expect a reaction of public and congressional confidence to become evident in 1963. This confidence could make it easier for legislation to solid a final act and adjust the space program with increased accuracy and its technical goals would be gathering significant speed.

After the Apollo program was established as a national goal, the next significant acceleration of the space program became evident in the series of technical competitions and contract awards that has put the large booster program into high gear and placed virtually all of basic Apollo hardware development programs into the hands of industrial contractors. At the same time, most of the facilities expansions required for the Apollo program were initiated and are now under way. This is truly a remarkable achievement for both the technical and administrative levels of NASA.

Another hopeful sign appearing on the space horizon with the new visit is the indication that NASA and the Air Force Systems Command are establishing an effective liaison at all working levels (AVF Jan 1, p 26). We devoted considerable editorial space last fall to emphasizing the agency of the military and liaison for a truly effective national space program. We also outlined the areas where the existing liaison machinery was inadequate. It is gratifying now to see these genuine progress being made in this vital area.

#### Lunar Program Enthusiasm

NASA has done a notable task in getting the Apollo program rolling, and men such as Vice President Lyndon Johnson, Dr. Edward Wehr, executive secretary of the space council, and James Webb, NASA administrator, have done a remarkable job in securing the interest of President Kennedy and congressional leaders in the space program as a significant national goal.

One of the major problems still remaining is to enlist the untold support of the American people and their legislative representatives behind the space program that has been so boldly charted and swiftly accelerated. For if this program is not adequately explained to the American people, they will soon become bored with it once the novelty of space spectaculars wears off, and the familiar tenets of indifference and waste economy that have strangled so many other promising programs will take over the space program.

—Robert Holz



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### In the Front Office

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Thomas F. Mori awards William B. Ricks as vice president of Lockheed-Corpus Co., Mexico City, a division of Lockheed Aircraft Corp. Ricks is now vice president of Lockheed Aircraft International, Los Angeles, Calif. Other Lockheed-Corpus appointees: Thomas F. Moore, ad manager; director, Maurice M. Egan, director of financial operations.

George H. Sullivan, M.D., corporate vice president SportsInk, Inc., Van Nuys, Calif. Dr. Sullivan oversees as the company's medical director.

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Henry F. Hall, Jr., executive vice president, Arthur Doreans of New Jersey, Inc.  
Walter A. Hahn, Director, Management Analysis Division, Office of Administration, National Aeronautics and Space Administration, Washington, D.C.

### Honors and Elections

**Funk W. Fink**, vice president engineering products for Buse Acoustical Co., has been named president of the Society of Automotive Engineers for 1967.

Queen Elizabeth II has named the following to the Order of the British Empire: **Desmond An Mardach** for Charles Dwyer, R.M. commander in chief, Mullagh East Community Centre; **An Mardach George An** for William Cunningham, Ulster Transport Commission; **An Mardach Douglas G.** for Martin, chief of staff, Allied Air Force, Central Europe; **Helen Blackburn**, personal secretary, Ministry of Agriculture; **Colin**

### Changes

**Dr. Arthur Raskaj**, assistant director, Systems Engineering, National Aeronautics and Space Administration's Office of Manned Space Flight, Manned Space Flight Center, Huntsville, Ala. Also Dr. J. F. Kuchner is chief of the Saturn Apollo Program, Saturn Systems Office, NASA, Manned Space Flight Center.

**Robert N. MacLeod**, engineering manager, Los Rios Division, Troy, Ohio, of Lear Inc.

## INDUSTRY OBSERVER

■ **Cost of developing the USAF-Douglas X-35b** exceeded \$1 billion, which is currently a plan at about \$410 million, which is more than twice the original estimate for developing a aircraft that would have had substantially longer range and higher accuracy than the one currently programmed. USAF actually sought additional funds to accelerate the program but was turned down by Defense Department.

► UNAF' briefing on proposed mid-airborne ballistic launch (MIRV) is imminent. Requests for quotation will be issued to industry on the basis of associate contractors for these areas: propulsion, command and control, guidance, in-cate vehicle, transporter-launcher, and the integration, assembly and checkout segment.

► **Discovert** program, which was to have ended last year, now has several dozen additional missions assigned. USAF's Strategic Command wants to launch about 15 **Discovert** per year chiefly as testbeds for Space reconnaissance and Media assets, carrying satellite systems, components and techniques.

► NASA's Jet Propulsion Laboratory is considering a combination of Titan 2 and the Agena C as an alternative to the Atlas-Centaur as a launching vehicle for the Mariner B deep space probes to be fired in 1964. Mariner B needed, possibly, will be delivered in 30 weeks in a 7-ft-dia. structure.

■ **Air Force Electronic Systems Division** will request industry proposals for design and fabrication of three air transportable AN/TRN-47 terminal area traffic control systems, designed for quick deployment to areas that have no control facilities (AWM 33, p. 79). The contract will include a search radar, precision approach radar, communications, VTR and IFR, tower voice, plus an AN/TRN-47 command-and-control system and which will be government furnished. Early delivery will be a major factor in the selection of a contractor.

► Competition for a lightweight, personal-area voice beacon which could automatically transmit UHF distress signals from a downed pilot will be held soon by Nav's Bureau of Weapons. Beacons probably would weigh not more than two pounds and would include provisions for short-range voice communication between the pilot and search aircraft.

► At least one firing in USAF's Project Ascent in thermodynamic structural systems evaluation tests is expected this calendar year, with several more scheduled for next year. Ascent calls for launching of a number of hypersonic glide models on B-57 Soviet bombers to study effects of heating on structures of the type to be used on Delta Star and follow on manned space vehicles (AW Apr. 10 p. 23). Glides will be fired to velocities of 70,000-20,000 ft/sec and altitudes of up to 400,000 ft.

► Minneapolis-Honeywell has been chosen by Naval Ordnance Test Station China Lake, Calif., to assist in preparation of the Advanced Research Projects Agency-sponsored infrared and electro-optic measurement study, called Telesense (AW Jan. 1, p. 13).

►Crucial features of sensors for pilots of the Dornier orbital glider will be attended by a new pressure suit which features convolutions at the elbow and knee joints. Movement on the inflated Dornier Suit is expected to be much easier than in the Mercury suit.

\* Russia claims geophysicists have been using chemically loaded rockets routinely to break up and storm up moaching vases in the Alatau-Lira Valley of the Georgian Soviet Socialist Republic. Eleven points on the peaks of the Tsh-Goudanovsk Range are used as firing sites. Rockets at the approaches to the valley give warning of the hail.

► Sixty-eight per cent of all NASA space launches now planned for this year already have not been scheduled in Goddard Space Flight Center.

# SILICOLOGY

## Studies in Silicones

HOW THESE TIME-TESTED MATERIALS  
CAN WORK FOR YOU

### Turn on the heat— Silicone-based coatings can take it!

If you want to take the outstanding characteristics of silicone resins, choose one that "best insurance" would also see the top.

Paint manufacturers who formulate high-temperature coatings have long been aware of this important property and are turning more and more to silicone resins as a base for their products. Within range of the way from lightweight pressure-resistant for electrical applications to special paints used on rockets and missiles, jet aircraft engines, and other advanced space vehicles.

In any case, the choice in silicone resin inevitably leads to one made by Union Carbide, not only because of their recognized reliability and uniformity, but because their resins are specifically designed to meet a specific paint requirement.

#### LOW-TEMPERATURE CURE

Take Union Carbide R-630, for instance, a new low-temperature curing resin which has been widely adopted by the paint industry as a base for applications. Besides and for paints on engines, turbines, compressors and other high-temperature electrical equipment. Thanks to Union Carbide's free from many of the handling problems inherent in the use of other silicone resins and may be applied even on sensitive surface by spraying, dipping, brushing, or dipping. Lighter in weight, more flexible and less expensive than organic coatings, it can be blended with acrylic esters to give them improved thermal stability and resistance to overloading.

The color range is virtually limitless and high-temperature resins based on R-630 have outstanding durability, self aging resistance and water repellency. In addition, paints based on R-630 can be packaged in aerosol sprays for convenient use on home ovens, stoves and radiators.

#### LOW-COST ALUMINUM PAINTS

To combine economy with performance, many large-scale users of paints are adopting Union Carbide R-64, a silicone resin which can be cold-blended easily



Silicone base aluminum paint, which greatly reduces oxidation up to 1500 deg. F., is sprayed on rocket engine, jet or turbofan parts of South Sea area aircraft. The paint known as CI "Worm Shell" is used by Chem Laboratories Co., Glenview, Ill., and is based on silicone resin made by Union Carbide.

with many organic resins in vehicles for aluminum paints. With only 7 to 11 per cent by weight of resin needed in the formulation, aluminum paints of this type give outstanding protection in the 500-1500 deg. F. range and still retain their ability to withstand under these high-temperature conditions.

Applied by brush or spray, such paints are used as protective coatings for aircraft engines and exhaust stacks, truck and engine manifolds and mufflers. Because of their ability to resist heat and metal scale stress, heat and flame-resistant protective clothing can also be fabricated from aluminum cloth coated with aluminum paint based on R-64 organic blends.

#### MAXIMUM THERMAL STABILITY

If factors of heat, weather, and corrosion constitute a major problem for you, take a look at still another Union Carbide product, R-601. Developed specifically as a resin vehicle for metallic and non-metallic pigmented high-temperature

coatings, it provides the ultimate in thermal stability and offers far greater heat, weather and corrosion resistance than organic paints. Its typical applications are in paints for wires, insulators, high-temperature electrical equipment, lamp shields and reflectors, engine stacks, piping, engines, motors, generators and high-temperature processing equipment such as the foundry or many chemical and metallurgical industries.

R-601 based paints can also be packaged in aerosol sprays for convenient use on home ovens, stoves and radiators.

#### LASTING QUALITY

Silicone-based coatings gain lasting longevity because they provide protection for longer periods of time. If you have a coating performance problem, look to Union Carbide. Silicons for your answer. Your Carbide Man at your nearest Carbide Sales Office, but better here, for the best experience and research of Union Carbide Corporation in virtually every field of industry. For information and help fill in the attached coupon and mail it today.



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City \_\_\_\_\_ State \_\_\_\_\_

## Washington Roundup

### Space Labor Study

Secretary of Labor Arthur J. Goldberg, who has helped settle labor-management disputes in fields ranging from grand opera to the airlines, will visit Martin Marietta Co. a plant at Middle River, Md., probably late this month, to take a direct look at the problems created by stop and go in the missile and space programs. Goldberg will be sought to make a case study of Martin's structure.

Martin announced last month that it would have to lay off 2,500 employees because of cancellation of some government work and failure to gain new contracts. Meanwhile, two work on the Titan 2 by one as a Dyna-Soar booster is ending, because Air Force has cancelled the substantial part of the program and will use Titan 3 for orbital flights, and work on the Space Shuttle is about completed.

Martin had hoped to take up the slack by winning National Aeronautics and Space Administration contracts for either the Saturn IB booster or the Apollo spacecraft, but lost both. Since the layoff was announced, Baltimore and Maryland legislative leaders have been urging the federal government to solve the unemployment problem by creating space and defense contracts to Martin.

Goldberg's recommendation to President Kennedy after his Martin visit undoubtedly will influence the availability of the space program. A good probability is that the Administration will give more money to it than it has in the past, to give employment problems in declining where the billions involved in the space program should be spent.

### CAB Proposals

Civil Aeronautics Board will propose "basic changes" in the bill, passed last year by the House and Senate but never moved beyond a joint House-Senate conference that would give more implemented reform permanent status. Chairman Alan Boyd told a House subcommittee last week. The subcommittee is investigating the appropriateness as a result of the recent Imperial Airline crash (see p. 40). Boyd said "basic considerations" will be proposed and the Congress in a week of a CAB Federal Aviation Agency investigation of the Imperial crash. The CAB has yet to approve the proposed changes, and Boyd did not say what they might be.

CAB will delegate authority to its bureau and three different to allow one-maning method, effective Jan. 30. Privileges, licenses and documents could appear but could not delay non-emergency matters such as applications to conduct or extend MATS charter operations. "This had to be referred to the Board for final. Still decisions can be appealed to the Board, but only once. The change is a result of Congress' group last July of President Kennedy's transportation plan for CAB.

### Consent Ownership

Federal Communications Commission is standing up to its position that "consent" ship of a space communication system should be limited to individual countries concerned. National Aeronautics and Space Council has recommended a broad base of ownership. FCC last week conference with the House and Senate committee on the subject. Legislation proposed by Sen. Robert Kennedy of the Senate space committee would give FCC the authority to decide which communication companies would share in ownership of the system.

Rep. George Mahan, chairman of the Key House Armed Services Appropriations Subcommittee, has accepted Secretary of Defense Robert McNamara's decision to withhold the \$55.6 million estimated by Congress last session for the Dyna Soar, the \$55.6 million used for strategic bombers, and the \$110 million voted for accelerating development of the B-70 bomber. Given a choice between spending additional money for B-70 or accelerating the B-70 development program, Rep. Mahan would favor the latter.

Deadline for industry's comments on Defense Department's proposed guidelines for (reactive contracts has been extended from Jan. 2 to Jan. 15. The proposals were circulated in October last Dec. 4.

### Civil Defense Funds

Drive for a two-year, \$5 billion-year civil defense program will be opened by Rep. Carl Albert, chairman of the Joint Congressional Committee on Atomic Energy. Hearings on civil defense are first on the agenda of the Government Military Operations Subcommittee, which Rep. Albert also heads.

Dr. Nicholas E. Golovin, former director of systems engineering in NASA's Manned Space Flight Office and chairman of the Joint Defense-NASA Large Launch Vehicle Planning Group, will become technical adviser to Dr. Robert G. Seamans Jr., associate administrator. Dr. Joseph Smith will replace Golovin as the system engineering job.

NASA may present its budget request to Congress in two rather than three broad categories. New categories would be one called research, development and operations and another called construction. Last year, requests were split into research and development, science and engineering and construction of facilities.

Adm. Charles E. "Cap" Brown, who retired as NATO's commander in chief, southern Europe, on Jan. 1, will join McDonald Aircraft as European representative. —Washington Staff

# Navy Plans to Launch Quintuple Satellite

Single launch vehicle to carry five separate satellites; experiments require orbits reaching high latitudes.

Washington—Navy will attempt to put five separate satellites into orbit with one launch vehicle on Jan. 24 or 25. The payloads to be known as the Composite 1 satellite, are scheduled to be launched from Cape Canaveral, Fla., into a 500-mi. orbit that will carry them to or high latitudes.

Three of the payloads are types that have been test run before as payloads on Titanit experimental navigation satellites and two are new. Four will be located into their own orbits and one will remain attached to the Able Star second stage of the USAF Douglas Thor Able Star launch vehicle.

Main purpose of Composite 1 is to carry experiments that require an orbit reaching high latitudes. To achieve such an orbit, an inclination of 65.5 deg from the equator was chosen. Ideally, the orbit will be at near circular as possible. It will be considered a successful orbit if the perigee is less than 400 mi. alt., and the apogee does not exceed 500 mi. alt.

Total weight of the five payloads will be 725 lb. Their range is over 20,000 mi. in diameter to 5.5 in. in diameter. The satellites are:

- Solar Radiation 4, which will be required to be SR-4.
- Luna 2.

- Secor, for Spectral Collection of Radar.
- Leth 2, for Low Frequency Transmissions.
- Sural, for Space Surveillance System Collection.

## Payload Management

Over all management and processing of Composite 1 is under Navy's Bureau of Weapons. The Naval Research Laboratory is responsible for payload preparation and for management of the SR-4, Leth 2 and Sural satellites. Luna 2 is under the guidance of the State University of Iowa and Dr. James A. Van Allen. The organization also will con-

trol from 21 operations in orbit. The Secor satellite is sponsored by the Army Corps of Engineers Research and Development Laboratory.

Aerospac Corp. will have overall supervision of the launch vehicle, including system engineering and technical direction and integration of the satellite payloads with the launch vehicle.

Launch of Composite 1 will be the responsibility of the Air Force, Space & Navy Division. The 455th Test Wing (development) of USAF's Office of Systems Research will conduct the launchings.

Space General Corp., formerly Space Electronics Corp., will build, assemble and test the Able Star stage. It also will furnish the electronics for Able Star except for guidance which is furnished by Bell Telephone Laboratories.

Space Technology Laboratories, Inc., will handle orbital computations and determine from its space navigation center.

SR-4 is an all-purpose payload 28 in. in diameter and is a modification of previous solar radiation satellites which were sometimes called Geph satellites. Incorporated in the globe will be three X-ray detectors and one Lyman-alpha detector.

Lyman-alpha radiation is a high-energy spectral, or ionization, line in the far ultraviolet range. This glow in the sky is believed to be produced by trapped hydrogen atoms.

Since hydrogen is abundant in space, it is presumed that there is a significant amount of Lyman-alpha radiation that might be a source of danger to crews of space vehicles. It could produce overexposure and damage the eyes. Satellites which have cameras and are of shorter wave length, are potentially more dangerous.

Three of the detectors in SR-4 will be shielded from Van Allen radiation belts which are the ion of energetic fields. The fourth will be shielded by boron.

SR-4 will have a greater wave length and sensitivity range than the previous SR-3 satellite, making it possible to detect more remote and lower X-ray data. One result of the experiment is expected to be a measurement of the ion's electron temperature.

In SR-4 crews into the earth's atmosphere, the Lyman-alpha experiment will be started by ground command to measure the earth's neutral hydrogen. This experiment will be completed in latitude and longitude to determine what geographical variations occur. SR-4 is expected to be in orbit for 10 days and will send data during that period.

The Luna 2 satellite is covered in

shape, measuring 16 in. on each side, and is made of magnesium. Extending from one side is a boom at the end of which is a small circular coil containing two magnetometers.

Luna 2 also will contain five gamma detectors, two photometers and two magnetometers. It will relay data to a digital telemetry station on command from the ground. It will provide measurements on natural effects in the earth's outer radiation zone and will measure light streams caused during auroral activity in the wave length range from 5,575 to 6,100 angstroms. It will also measure the electron energy spectrum in the outer radiation zone above the level of auroral activity.

The Secor satellite is an aluminum sphere 28 in. in diameter. It carries three in a monopulse that will gather geographic data which will be transmitted to the ground on two independent, shared frequencies. This data will be used later in the control of the Able Star satellite which is under the coordination control of the Army. Secor is expected to produce information on mass excesses of the shape of the earth beyond that discovered by the Navy's Titanit satellites and to tie the earth's distance together with greater accuracy than before.

Leth 2 will continue previous experiments in the very low frequency electromagnetic range to measure how well these frequencies penetrate the ionosphere. Normally, each of the electromagnetic energy at these frequencies is reflected in the ionosphere and carried around the earth. If they are transmitted through the ionosphere, this range of frequencies may be useful in space communications.

One of the highlights of Leth 2 will be the determination of signal attenuation through the atmosphere in relation to latitude, with the poles giving the clearest atmosphere. Earlier Leth satellites detected ionospheric disturbances in atmospheric altitudes from day to night and by latitude, with the best transmission being measured at low latitudes at night.

The Sural experiment is contained in a cylinder that is 5.5 in. in diameter and five and one-half inches long. It will have no telemetry, written as such but it will be able, on ground command, to send data for a one-quarter period during each orbit. This signal will be used for calibration of the space surveillance system which will be tracking the satellite. It is also indicated that Sural will carry an optical tracking, and

From HSTH the Sural satellite stage will have about 165 lb. After the Thor boosters the Able Star stage will be separated and will carry about 200 lb. to about 455 mi. after takeoff. A long coasting period will follow. At approximately 1,730 mi. after liftoff the Able



FIVE SATELLITES will be orbited with one launch vehicle by the Navy later this month from Cape Canaveral, Fla. Three of the satellites—Leth 2, Leth 2 and SR-4 (previously called Geph)—have been shown Titanit launches before. Secor 1 and Sural will be flown for the first time.

Star will be separated to assist the satellite into orbit during a one-hour coasting period. Separation will be completed prior to reaching the South Georgia Islands.

Data for control of the Able Star will be relayed by a mobile tracking station which will be stationed near Puerto Ayacucho, Argentina, at the south coast tip of South America. Data on the Able Star, interest, interest of payloads into orbit and payload separation will be transmitted to the space navigation center for rapid computation and retransmission of control signals to the mobile system and other systems which will send the command signals.

After separation into orbit, the first satellite to be separated will be the SR-4, which will be attached to a rap-

port tube on the Able Star. It will be separated by spring. Earth station around the support tube and slightly lower than the SR-4 will be the Luna 2, Leth 2 and Secor. Each one will be at the end of a spool fastened at the base of the support tube. They will be separated in the order mentioned above. Sural will remain attached to the Able Star stage.

The boost and coasting phase of Composite 1 will take the vehicle over most of South America. It will pass over Colombia, Venezuela, Colombia, Peru, Brazil, Bolivia, Argentina and Brazil again.

The South Georgia Islands, near which separation into orbit is completed, are located about 630 mi. east of Puerto Ayacucho.

## Kennedy Stresses Economic Strength

Washington—President Kennedy will ask the 87th Congress for a transfer of revenue dollars to strengthen the U.S. against the Communist economic blockade, he said yesterday in his address to Congress.

President Kennedy described economic war by State of the Union Message delivered to Congress Dec. 11. His call that although moral and physical strength began at home. The country must build strength both in nuclear and conventional military forces because we "live in a perilous world."

The President pointed out that in his requests to outline laws, with details to follow throughout the session, he has directed progress he seeks:

- A manpower training and development act, to provide new skills and jobs for workers entering the labor market and for those who have lost their jobs because of automation or conversion of their factories.

- A law to create a 50% for new investments in research and development, and a statute on depletion allowance. These factors will spur modernization for more effective competition in the world market.
- Studies authority to coordinate federal capital improvement program of unemployment rates and similar authority, subject to congressional review, to achieve personal income rates from a 20% level to 1956.

President Kennedy called the strengthened military program of the U.S., and the "speed new effort on outer space," which began in May with strong congressional backing.

In the past 12 months," he said, "one million people have steadily increased. We have increased the previous federal budget by 15% (note that doubled the acquisition rate of Polaris submarines—doubled the production capacity for ballistic missiles and increased by 100% the number of nuclear launchers standing on 15 minute alert).

He called upon a "first new frontier of science, research and world-wide exploration—this is the new frontier among the first to explore it. We are offering our hands and cooperation to the United Nations. Our satellites will soon be providing other nations with improved weather observations." He said he will have brought to Congress a plan to permit financing and operation of an international communications satellite system.



## U.S. Research Contracts Study Aimed at Winning National Goals

By Katherine Johnson

Washington—Achievement of national objectives is the basic criterion the Budget Bureau will use in determining how research and development projects should be divided among government departments, non-profit organizations, and profit-making firms.

The study will be ordered by the President [Feb. 5] and the Defense Dept. Although Budget placed a high priority on the project, it now appears that it will be Alaska before that work is completed, and probably April before recommendations are submitted to Congress.

A Defense Department study of the role of non-profit organizations, requested by the House appropriations committee, has been abandoned in favor of the government-wide project.

The Budget study is under the direction of Harold Soderstrom, acting chief of the office of management and organization, and Gerv Pemberton, economic analyst. They emphasize the need for perspective, and note the fact that most of money allocated by the method of performance of research and development—either in cost or cost of government, patent rights, product of research, advertising policy and cost reimbursement policy.

Considerations of the non-profit organization in the past generally have focused on what Soderstrom views as "subsidized research." They have concentrated on such specific issues, for example, as whether the non-profit research activity in effect establishes government policy,

or whether personnel of non-profit organizations have profited economically in salaries or through access to government and government contractor information.

The Budget Bureau's study will weigh the merits of intramural research against extramural research. This it will consider extramural contracting with profit-making firms in support non-profit organizations. Finally, in the non-profit area, it will evaluate four types: those with universities, those with firms established to meet a specific government requirement, those with government-owned and -operated facilities, and those with federal research centers, such as Jet Propulsion Laboratory. Because it emphasizes the non-profit research view of a selective number of key efforts in and out of government, it will also include a broad-based statistical type survey.

Eight questionnaires were sent, 11 of them to the heads of government agencies. The 69 written field responses were divided into government agencies and contractors.

Although the study is concentrating on Defense Department, National Aeronautics and Space Administration and Atomic Energy Commission and their contractors, it will also solicit input from other agencies, including FAA and National Science Foundation.

In the case of Defense, the Budget Bureau is obtaining views on five activities: management of defense, aerospace technology, technical staff, command and laboratory facility.

The non-governmental respondents were selected in hopes of achieving a "diversity concept" by type—small or giant, or size profile, or geographical location, by size, and by government agency sponsorship. As profile types, Martin Marietta Division of North American Co., Rockwell International, North American Aviation, and Lockheed Martin's Space Division were named.

The questionnaires were filled out by an open mail selective number of about 40 potential respondents. During the next two weeks, officials in Washington will be telephoned officials in Washington, including Secretary of Defense Robert S. McNamara, NASA Administrator James E. Webb, and AEC Chairman Glenn T. Seaborg.

At the outset, Budget Bureau limited the scope of its study by excluding all defense contracts and those for production, training, supply management, communications services and research and development activities in social, psychological, and economic fields.

In his letter to Budget Director David H. Bell, the President asked that the study focus on these six criteria:

- "The effect of the use of contractors in direct federal operations, the federal government system, and the government's own capabilities, including the capability to review contractor operations and carry on scientific and technical work in areas where the contract device does not seem to be the best solution."
- "The policies, if any, that the government should follow in controlling the situation of large numbers of personnel working under a contract, and the appropriate management and dismissal of such personnel."
- "The criteria to be used in determining whether to perform a service or have it done by a contractor, and the effect of such federal operations, including air support considerations to be given to the nature of the contractor and his relationship to production contractors."
- "The policies to be followed in contracting for research, including the effect of contracting for research for the sole purpose of referring out contracts with the government."

"The means for streamlining and improving contractor operations and achieving maximum efficiency in such operations and."

"The policies which should apply with respect to contractors fees and cost reimbursement, and on item such as overhead, facilities and equipment, and advertising."

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## GE Designing Low Cost Turbine Engines

By David A. Anderson

Detroit—General Electric Co. is designing a new range of gas turbine engines for light business aircraft at a cost of \$700 to \$1,000.

Both turbo-prop and turbo-shaft engines they should be competitive with piston engines in price, and should give no cost direct operating costs lower than today's light twins according to the company.

These new turbines will be neither derivative nor extrapolation of today's engines. H. J. Noyak said in a report prepared for delivery at the Society of Automotive Engineers Automotive Engineering Congress and Exposition here. Power will be pegged to levels in the \$7,000 to \$10,000 per engine range. Direct operating costs for a typical 7,000-hp. turbo-prop-powered aircraft is estimated at 12 cents per gallon, compared with 15 to 18 cents per gallon for an equivalent piston-engine twin.

Noyak said new concepts of design and manufacturing will strike a balance between application and low cost. Internally fired combustion and use of atomization of the gas turbine will be stressed or ignored.

Parallel to this effort, Noyak indicated new studies by the surface areas facilities to reduce their thrusting costs for the next generation of high-speed aircraft.

Noyak predicted that in 1967 it would be possible to test a 7,000-hp. light twin turbo-prop aircraft with an engine performance comparable to or better than piston-engine types and for as low a cost.

Other highlights of the program: Lockheed C-141A jet cargo transport aircraft, operating for the next 10 years, will be followed by meeting of Federal Aviation Agency's preliminary

type certificate issued H. H. Slaght, Jr., FAA's chief, Engineering and Manufacturing Branch. Southwest Re group told the SAE that 14 major test programs are now under way on the C-141. The engine division from the original USAF specifications have been applied in designing the aircraft to Civil Air Regulation Part 25. Design suggestions come from FAA, which returns and advises before to check that compliance with Civil Air Regulations include separate sets of power controls for pilot and copilot, must increase in the extreme width of the flight deck.

FAA pilots will be at the controls of the C-141 during its qualification flight tests in Edwards AFB, and will also perform some of the flying during position area checks and other qualitative tests.

• Super-sound transport design are still a long way from the final stage, as indicated by comments made by FAA members of the program, a representative of the National Aeronautics and Space Administration, and a low altitude executive. FAA's Fred Hoffman, technical assistant in the agency's representative transport program, aeronautical office, said that these super programs are currently being approved by the agency's committee. NASA sponsored and made up of military and government agencies, it is currently preparing plans for further evaluation the Air Force has by contracts supported by FAA funds for propulsion cycle analysis and a joint NASA USAF FAA

some basic research programs in engine performance, reliability, and other factors in industry field. NASA, a not directly committed to verify, generate configurations for the aerospace transport. He had only one main configuration, a turbo-prop, and the other two had two fuel systems. Results are being studied.

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"The year's SAE congress swing back toward the traditional automotive approach of the month's work. Only a few reports of general aeronautical interest were scheduled, and almost no reports on engine development, including."

The show is conducted with test sessions, which included a full day's technical sessions devoted to the theme of a flight to the moon, plus a large number of other aeronautical and space subjects treated in presentations at tech area meetings.

Major portions of the exhibit last year dealt with various themes of aeronautics and space. For now these were health care.

## Minuteman Silo Shot Tests Strength Effect

Third straight successful firing of a Minuteman solid propellant antero-missile ballistic missile from an underground silo at Cape Canaveral was made last 3 in a launch which set the missile on its way to the target.

The shot tested reactions of the re-entry boost and its contents to higher temperature conditions than occurred in re-entry speed.

Because of the extremely high elevations of the missile portion of the pre and flight the first stage, moving full back into Atlantic Ocean several miles from shore. At that location the main missile shell produced a very gradual, well-defined water fall.

Following analysis of this condition, two parachute were dropped into the sea by an F-108 helicopter shortly after the first stage fell. This marked the location of major fragments for later recovery, and recovery of missiles used in identification and analysis.

## Three Council Titles Modernized by AIA

Washington—Names of three Aerospace Industries Assn. councils have been changed to describe more accurately the area with which they deal.

• Aerospace Manufacturers Council, formerly the Aircraft Manufacturers Council. This includes AIA President August E. Korman, the 26 members of the board of government and 14 associates of member companies.

• Missile and Space Council, formerly the Guided Missile Council. This group is composed of 31 manufacturers' representatives.

• Vertical Lift Aircraft Council, formerly the Helicopter Council. This group of members from 16 companies.

## Orbiting Observatory

An advanced 400-lb. orbiting astronomical observatory scheduled to be launched by 1967, is being designed by the space division of the AEC, at University of California at Berkeley, where it is located at Kitt Peak National Observatory in Arizona.

A USAF Martin Marietta F-4 Phantom II aircraft will be used to place the observatory into a 30,000-foot orbit and maintain it. The project is funded by a National Science Foundation grant and is scheduled to launch a \$20 million, ground-based, 400-lb. infrared telescope project, which has been awarded.

Current tentative plans for testing an infrared remote sensing in an AEC-USAF project, to be launched in 1967 from Cape Canaveral, Fla., into an orbit with a 30,000-foot altitude and 200-mph orbit, pending.



# Army to Streamline Research Activities

Washington-Arms plan to expose the cost effectiveness of its limited research and development budget was described by Vice J. Lanes, assistant secretary of the Army for research and development, at the Lyndon National Symposium on Reliability & Quality Control last week.

Army's research and development activities will undergo "some organiza-

tional changes . . . in the very near future" to achieve responsible and prompt decisions, Lanes said. This referred to a recommendation by Arms Secretary John Stille, Jr., that all research and development projects be considered as a new Research and Material Command (AW No. 39 p. 15).

Army, a continuing dropping the requirement for metal production con-

tinues to prepare a whole new set of manufacturing drawings to Arms specifications for use in subsequent competition bidding. Owing a subsequent contract under a third set of drawings to its own standards, at government expense.

## Low Quality Prices

More complaints that bid on military contracts have been a desirable degree of competition, especially in the electronics field where it is comparatively rare for a few engineers with a good idea to obtain a small contract from the government, Lanes said. "A few months later these able engineers can become engineers in the administration or business side of their contract and may fail to handle a number of contracts with an inexperienced engineering organization," Lanes said at the symposium.

"I am for small business and I think there should be the opportunity to start a new small business, but at the same time there should also be the opportunity for small business to bid," Lanes said. He pointed out that although almost one third of all new small business firms fail in their early years, during the past few years more than 4,000 small business firms have had a steady-state rate of which he said failed. This suggests that "we are almost certainly covering too many areas of those at marginal and submarginal business operations and that our government is not getting its money's worth from many of them," he said.

Lanes said that the Army, like other services, is greatly concerned about cost and delivery programs and will not consider type contracts whenever possible to provide controls and penalties in contract performance.

## Warning on Soleris

Increased cost of defense research and development, which has doubled in the past decade, is largely due to the increased rates, levels of engineers and scientists, Lanes said. While admitting that he did not think present levels are excessive, Lanes cautioned that they are not continuing to increase at past rates "without serious implications to our country's defense operations."

The situation is especially acute because of increasing research and development by the Defense Department and the National Aeronautics and Space Administration.

Lanes also mentioned the concerns of top scientific managers in preparing early proposals, but offered no solution to the problem.



## Hawker P.1127 VTOL Prototypes Modified

Changes in two prototypes of the Hawker P.1127 VTOL, single engine, aircraft can be seen by comparing the first two aircraft, one of which (440) needed after engine loss of its first rotating motion of its forward-folding delta wing (AW Dec. 25, p. 15). The No. 2 prototype of right is fitted with bell-mouth inlet for better flow characteristics. Aircraft is used for testing in the VASTOL system (AW Dec. 5, 1980, p. 31). Bellmouth had been discussed on the No. 2 prototype for the high speed test runs in which the aircraft attained supersonic speeds several times. Outlets for gas have been drilled up for second landing and the main gear door closed. Black holes on top of fuselage are an auxiliary power unit with air-driven hydraulic pump. Redding nozzles are marked in white for wind indicators of thrust deflection.

## White House to Use HSS-2 Fleet

Washington-Eight. Shortly HSS-2 two machine helicopters will be used for the White House staff as a temporary replacement for four Marine HUH-1 and four Army H-14A single rotorcraft engine aircraft.

The HSS-2 passenger conversion will be quickly decided between the Marines and Army, containing the purchase of splitting the presidential staff evenly between the two services.

The HSS-2 will be replaced later with the White House staff as a temporary replacement for four Marine HUH-1 and four Army H-14A single rotorcraft engine aircraft.

Although the HSS-2 is intended to operate as an amphibious helicopter, the White House staff will be taken from the production line.

Helicopter staff for presidential parties was used sporadically in the 1950s at the rotary wing aircraft reliably employed. By 1957 the Marines and Army were providing service on call to the White House from helicopter units in the Washington area.

In 1975 a special Marine-Army unit was formed with presidential staff as its specific mission. It would staff the President and key staff members as a

rotary emergency directly from the White House. In the alternate command post at nearby Camp Ritchie, Md. which is based under a constant.

The chief unit is based at the Naval Station, Annapolis, Maryland, the Naval Air Station. A single aircraft can take off, skirt the Potomac River and land on the White House lawn in 5 min.

Most of the unit's operations are under presidential protection in real time. Andrews AFB, Md. Area where the Air Force's presidential special mission. The unit is expected to be operational by the President and from his Middleburg, Va. estate.

## France to Organize Strategic Air Group

Paris-Contact air force chiefs will set up a strategic air command which by 1985 is expected to be operational, equipped with Dassault Mirage 4 fighters and armed with nuclear force bombing.

Creation of the new command was decided by Gen Paul Strehler, air force chief of staff. The French air force has ordered 50 Mirage Mach 2 fighters to be replaced by two prototype aircraft and the initial prototype has been ordered 50 by the end of the year.

In 1975 a special Marine-Army unit was formed with presidential staff as its specific mission. It would staff the President and key staff members as a

## New Space Track Radar

An Air Force Electronic Systems Division has asked for industry proposals for development of a new high-power radar, the first specifically designed to detect and track satellites and to obtain complete orbital characteristics in a single pass. Development is being handled by Rome Air Development Center, which expects to award a contract by March. Project also calls for the radar to be installed in Florida to permit tracking of satellites in equatorial orbits. Nearly a dozen companies are expected to submit bids.

present air transport group. The latter has been used constantly at an annual French air force transport mission. The new transport command is based on the need for a strategic air command for combined services.

Centers of the new transport command will give rise to the fleet over the current lack of adequate, military air transport. During the Berlin crisis, the French government considered every good purchase of Lockheed C-130 transports, but finally dropped the project (AW Dec. 25 p. 30).

The French air force's main military transport remains the Nord Anvers Nordair, a two-engine transport aircraft with relatively short range. The Nord Anvers C-130 is in transport aircraft was not operational with FAF until the mid 1960s. Thus most French military efforts continue to pour for purchase of Lockheed C-130 transports to fill the gap.



## Rigid Inflatable Sphere Satellite

National Aeronautics and Space Administration's Echo 2 HSB, rigid inflatable balloon satellite, designed as a passive communications experiment, was scheduled for launch last week. When inflated satellite looks like a 4 ft. dia. 10-in. high center cone top shaped which weighs 100 lb. Surface photo shows closeup of number 11 Langley testbeds series adjustments (AW Jan. 5, p. 24).





LEECH HERITAGE OF THE AIR—17

## RICKENBACKER: AMERICA'S ACE OF ACES

Out of the men the Americans came, the sights of his SPAD set on the crest of the five Fokkers below. One long burst of fire sent the German falling wildly away as the SPAD plunged down through the Fokker formation. Below, alarmed and racing for safety, were two Hallenbach two-seaters. The Americans jockeyed for position, finally found an opening between them and scored his second kill of the morning as the second Hallenbach passed through the SPAD's line of fire.

It was September 25, 1918, a momentous day for Captain Edward Vernon Rickenbacker.

On his first morning as Commander of the 94th "Hell-in-the-Heaven" Aero Squadron, Rickenbacker had gone on single patrol over Verdun and east toward Rheims, where he encountered the Hallenbachs with their Fokker escorts coming out of German territory on a photographic mission. In minutes the man who was to emerge from World War I as America's "Ace of Aces" had made two kills and was headed far for his own lines.

One of the nation's top racing car drivers before the war, Eddie Rickenbacker had set a world's speed record of 128 mph in 1914. When the United States entered the war he gave

up his racing career and \$40,000 a year to serve as General Pershing's staff driver. But Otto-born Rickenbacker was eager for combat. Once in France, he assigned his way into training at the flying school at Issoudun.

The future Ace won his commission in January, 1918 and scored his first victory the following April after six weeks of front-line flying. A daring fighter—but never a headlessly one—Rickenbacker fought with cool, math genius.

Generally regarded as a tough customer by the college-age men of the 94th Aero Squadron, the 27-year-old speedster from Columbus was a natural leader. He was a buster mixed with coolness and logic. As a flight commander he was prudent but fearless, an officer widely concerned for the safety of his pilots.

Rickenbacker's 94th Aero Squadron was the first American unit to participate actively in the Western Front. When he was posted to the squadron in March, 1918, it was headed by Major Russell Lafferty, who had become an Ace with the famed Lafayette Escadrille. Until the summer of 1918 the 94th flew French Nieuports. These were replaced by the more rugged SPAD, a faster climbing but less maneuverable pursuit plane that accounted for most of the squadron's victories.

Rickenbacker scored 23 of his kills in a SPAD. His official score was 22 planes and 4 balloons. It was a phenomenal record, because he flew at the front for only seven months, and for more than two months of that time was hospitalized for a mustard gas injury.

In all, Rickenbacker received 13 decorations for bravery, including the French Croix de Guerre with Palm. The most proud of his citations was the Congressional Medal of Honor, the highest award a proud nation could bestow. Today, after serving his country in two world conflicts, Eddie Rickenbacker continues to merit the admiration of awestruck Americans as a leader in the field of commercial aviation.

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Technical Director for Heritage of the Air is Lt. Col. Rickenbacker S. Brown, U.S.A.F.

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## Suit Reveals TWA-Eastern Merger Bid

Tillinghast discloses merger discussion during pre-trial deposition hearings in TWA suit against Hughes.

By Glenn Garzner

New York-Trip officials at Eastern Air Lines and Trans World Airlines met Dec. 4 to discuss the possibility of merging their two airlines, it was disclosed last week in testimony here in TWA President Charles C. Tillinghast's deposition hearing in the TWA suit against Hughes.

Tillinghast's reference to the merger discussion was made during taking of deposition in pre-trial proceedings in the TWA suit against Eastern Hughes, filed June 30 in U.S. District Court here (AW Aug. 14, p. 42).

The suit alleges violations of the Sherman and Clayton Antitrust Acts by Hughes, Hughes Tool Co. and its former M. H. Hughes, who is Hughes' representative in the three-man voting trust for the Hughes 75% of TWA stock. The suit also seeks stock certificates in defendant and damages against merging TWA and its management, attempting to cause control, and acquiring TWA stock.

In the opening round in taking of depositions, Tillinghast was asked to recognize for first time in Charles C. Davis' office in New York. Spurred by Hughes' counsel, Davis and John J. Sennett representing TWA, the questioning concentrated on the subject of the TWA merger.

Relationships between Tillinghast, Ernest Borchers-TWA board chairman and a strong supporter and the financial institutions responsible for raising up the voting trust were also under discussion. It was apparent that Davis was attempting to show that Tillinghast's authority is negligible compared with that of the financial institutions and of

Borchers, and that the financial institutions and Borchers actually met the defendant M. H. Hughes, who is Hughes' representative in the three-man voting trust for the Hughes 75% of TWA stock. The suit also seeks stock certificates in defendant and damages against merging TWA and its management, attempting to cause control, and acquiring TWA stock.

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intervention to effect TWA's assumed solution of traffic. Eastern was "not merged" the first choice after that came National and Northeast, without much choice between them.

After a TWA directors' meeting Sept. 18 various directors and Tillinghast himself together and possible merger partners were discussed, with the consensus favoring Eastern. The director who first brought the subject up Tillinghast testified, probably was Borchers during a pre-trial deposition with Tillinghast.

Previously, Tillinghast and MacArthur had met for the first time and the subject of merger had been discussed briefly.

On Sept. 26, following the Sept. 20 discussions with TWA directors, Tillinghast met with MacArthur in a car to Westchester and discussed merger possibilities.

MacArthur was "yes and no" in his attitude, Tillinghast testified. MacArthur said he had spoken with Eastern's board and let Tillinghast know the board's reaction. In view of the numerous elements and the financial situation toward merger suggested by East American, Borchers, MacArthur and Tillinghast, the merger possibility should be pursued further. But it still was not clear, MacArthur pointed out according to Tillinghast, what kind of merger the CAB would approve or not.

The CAB would approve or not what the Board of directors stands on. The United Capital group, he mentioned, did not provide a good test of CAB attitude.

Next development cited by Tillinghast occurred at another TWA board meeting, held November, when Tillinghast mentioned to Borchers that there had been little progress in merger discussions with Eastern.

### 'An Old Idea'

Borchers then said Borchers had called him shortly after Borchers became voting trustee at the Hughes Tool Co. stock and suggested that Borchers and Borchers should talk about the possibility of merging TWA and Eastern. Borchers said he had to have advised to the possibility in the fraction of an old idea of 15 years ago, when Borchers was with TWA and the old mail contracts had not been cancelled. At that time, according to Tillinghast's account of Borchers' conversation, Borchers and Borchers discussed the same merger possibility. Following this conversation between Borchers and Tillinghast



British Trident Transport Makes First Flight

First de Havilland DH-63 Trident jet transport, ex British European Airways' markings takes off on its initial flight Jan. 9 at Hatfield, England, with Chief Test Pilot John Cunningham at the controls. Flight lasted 1 hr. 33 min. and included climb to 60,000 ft. and cruising speed up to 800 kt. FPA has ordered 24 Tridents with an option on 12 more with delivery set for early 1963. H. G. Sturgeon, de Havilland managing director, and the company is negotiating airline orders for 25 more Tridents. Follow-on model will be the Trident II, which will have greater seating fuel tanks to stretch range (AW Jan. 1, p. 30). Passengers are three Rolls-Royce Spey turbojets.

the meeting with Borchers and MacArthur was at an attempt to explore the merger possibility.

The possibility is still under consideration, Tillinghast told American Wire, but has a very "low priority" status at the moment.

Introduction of the merger discussion into the deposition questioning was prompted by Sennett, who is a partner of Cahill, Carles, Rosenthal and Altman representing TWA in the suit.

Sennett objected on the grounds that the discussion was not within the scope of proper examination in the proceeding. Sennett said the subject was not pursued and requested additional questions. In TWA indicated by Hughes Tool in continuing efforts to merge the airline in the interests of Hughes Tool only. Sennett said, however, that

the questions could continue since TWA's primary concern was to get on with the litigation.

On Dec. 14, Hughes Tool is making an organized effort to depose the 75% stockholders in TWA—i.e. Hughes—alleged rights of a stockholder. Due to the status in TWA's and against Eastern, Davis said, in the charge that Hughes Tool's effort to bring about a merger of TWA and Northeast Airlines is a conspiracy to violate anti-trust laws. Eastern has been trying to merge Northeast for some time, Davis said.

Davis said Tillinghast if the voting trust could consummate the merger whether or not Tillinghast the TWA directors and Borchers behind a TWA-Eastern merger would be in the best interests of Hughes Tool.

Tillinghast replied that in effect the

could. He said management should be controlled by interests of stockholders in a group and not influenced by interests personal to one stockholder.

Among the charges between counsel was over the presence of a reporter at the deposition taking. Sennett said TWA had not asked for or contacted to any publicity regarding the depositions and accused Hughes of inviting the press to the sessions. Davis said he had merely answered questions in court and where the session would be held, and said Hughes Tool had no objection to attendance in the press.

Sennett said that it had been stipulated between the attorneys that signing, sealing, filing and certification of the depositions be waived. Restrictions regarding publicity to be given in pending lawsuits issued, Sennett said, a "press problem" as to whether the action was being taken to take into consideration in suit, request with counsel for TWA represents a violation of the rules of court.

"If you are trying to give me a lecture, Mr. Sennett," Davis replied, "I suggest to you that a proper place for you to state your objections."

The taking of depositions was adjourned last Wednesday until Jan. 24. This was over the objections of Sennett and the matter was taken to court last Wednesday afternoon. The court advised the adjournment, but it appeared a legal advice—a special master to sit in on the sessions when this matter is dealt with arguments and procedure.

## Eastern Plans Jet N.Y.-Miami Shuttle

New York-Eastern Air Lines plans to extend its metropolitan hub-and-spoke shuttle to include jet service between New York and Miami beginning Feb. 9.

There will, however, be some differences between the jet shuttle and the currently operating propeller shuttle between New York and Miami and New York and Washington. Tickets will have to be bought beforehand and will not be sold in flight as in the propeller case. Furthermore, several coach seats will be sold on all jet shuttle flights and Eastern says it will be available on some of the flights.

There will be an hourly service, as mentioned some on a particular flight will be guaranteed.

Under the terms for the new service flight will work one way later between New York and Miami will be \$75, including tax, for daytime flights and \$57 after 5 p.m. a saving of more than \$10 over time jet coach fares round trip between the cities. Eastern plans to operate 12 daily nonstop jets on the service.

Eastern's new service would add further to the impact Eastern's greatly expanded jet capacity is expected to have on the Florida market this winter (see p. 44).

## Air Traffic Plan Timetable Announced

Washington-Like 14-man system design team appointed to carry on Bureau Report recommendations on air traffic control (AW Nov. 27, p. 45) has been told to submit a draft of its master implementation plan this morning, Federal Aviation Agency Administrator N. E. Hobbie said last week.

FAA's Aviation Research and Development Service then will be given 16 months to begin operation an experimental working prototype of the system at the National Aviation Facilities Experimental Center in Atlantic City, N. J., Hobbie said in a speech to the Airport Executive Club here.

Status of the new detailed concept of the system will be tested by the Major Group Hobbie said. The little group a study of whether the Air Force's Space Intercept system could be used for civil ATC purposes also was mentioned by Hobbie.

Report called for a new ATC system that would cost an estimated \$180 million. It is expected over the next few years and generally be based on existing radar in the primary instrument of air traffic control.

# Hearings Threaten Supplementals' Status

By David H. Hoffman

Washington—Supplemental airlines' effort to win permanent status through new legislative proposals was damaged last week when hearings before a House subcommittee confirmed testimony lightly critical of the industry and the regulatory agencies that govern it.

Subcommittee questions asked at first witness Paul H. Rife, deputy assistant secretary of defense for military transport and logistics, also disclosed that Air Force has replaced Airtex as traffic manager for all domestic airtex passenger movement. Authority for this shift is a policy statement issued the week before the hearing by Defense Secretary Robert S. McNamara.

Proceedings for transferring responsibility under the new directive remain to be developed. Meanwhile, Military Air Transport Service has begun planning renewed emphasis on regulatory activities in passing upon such supplemental airlines and certificated route carriers—also eligible for government contracts. At least two supplemental airlines, such as United, are being considered for domestic airtex routes primarily because of financial inadequacies uncovered by recent MATS "health" examinations.

In the absence of timely legislation, the opening of military air transport activity, according to congressional estimates, is expected to expire on May 14. While Douglas House and Senate bills that would establish these categories as permanent charter carriers are placed before a joint subcommittee committee late last week. The conference committee draft was provided by the Senate of a Lockheed Constellation operated by the supplemental Imperial Air Force, in which 74 Army aircraft and three crew members are killed (AVW Nov. 25, p. 87).

Appearing before the three subcommittees of the House Armed Services Committee at last week's hearing, Rep. Francis E. Walter (D-PA) said that if

Congress allowed the supplemental operating authority to lapse, it would make a contribution toward what Rep. Walter also recommended that the House and Senate in vote their respective bills, after full debate, if the conference committee could not agree on a compromise version.

Rep. Walter told the subcommittee: "One of the claims these carrier [supplemental] have repeated over the years is that they are needed by the Department of Defense. It is not one 'house' but of the departments would need to be the equipment they own. Equipment they lose is not lost because it is available to the Department of Defense elsewhere; they just transfer it to the next owner of these carriers."

At Sept. 10, 1962, Rep. Walter said, "all or virtually all" of the supplemental carriers could be of 72 Douglas C-124 or Lockheed Constellation type aircraft. Of these, two have been destroyed in crashes, one belongs to a bankrupt carrier and five are owned by carriers declared unfit in MATS as according to Rep. Walter.

On Nov. 17, following the hearing, President, Defense Secretary McNamara issued a directive that banned the carriage of individuals in excess of passengers to supplementals (AVW Nov. 27, p. 37). He also ordered that with supplemental approved by MATS carriers would be eligible to fly domestic routes for the military.

## Eligible Carriers

MATS Civil List Gen. Joe W. Kelly testified that the following airlines have been subjected to such checks and cleared to carry military passengers: American East, American Air, Capital Airlines, Braniff Airways, Trans-World Airlines, U. S. Citizens Airlines, World Airways and Overseas National Airlines. Gen. Kelly generally refused to name the carriers listed in MATS Civil List, saying that Airlines, Transport Canada, which has licenses in California, Hawaiian Airlines recently had

an eligibility audit. But Rep. Walter, denoting the banned status of each supplemental, charged that these carriers have failed to obtain MATS clearance.

▲ **American Transport.** ATC's civil north route, as Sept. 16, was 199,830. The Civil Aeronautics Board now is investigating whether its operating authority should be continued after Bureau Commerce discovered the airline incurred an operating loss in a long-term debt but discharging its current debt-to-equity ratio from an actual 1 to 6.6 to an equity 1.8 to 1.

▲ **Associated Air Transport.** AAT's north route, as Sept. 30, was 517,400 current. Current liabilities exceeded current assets by \$252,000. The airline, according to Rep. Walter, was declared unfit by MATS for financial mismanagement, substantial maintenance and substandard quality of service. It is noted that CAB recently shut AAT's two last three accidents in the last four years.

▲ **President Airlines.** Rep. Walter said that because he could not obtain a license for this President Airlines, it must be assumed that the airline is not operating with CAB as required. He said he was told that MATS recently has declared the company financially unfit. On Sept. 31 a President DC-6 crashed at Shreveport, La., killing 51 persons (AVW Oct. 16, p. 48).

▲ **Standard Airways.** Standard's current liabilities were \$307,000, its current assets \$251,200 and its working capital deficit \$154,500 as Sept. 30 according to Rep. Walter. He said that the airline was because of substandard maintenance and maintenance records, but not for financial mismanagement, Rep. Walter said.

He said that conduct MATS's eligibility survey would consist of 11 airlines: Braniff Airways, Gen. Kelly and crew the service about \$1,900,000. MATS began checking carriers competing for MATS civil routes, which includes Transport Canada, which has licenses in California, Hawaiian Airlines recently had an eligibility audit. But Rep. Walter, denoting the banned status of each supplemental, charged that these carriers have failed to obtain MATS clearance.

Both Gen. Kelly and Joseph Imbri, assistant secretary of the Air Force, for example, rejected the subcommittee's contention that the services provided by MATS carriers are needed by the Department of Defense. He said that the FAA, CAB supervision of supplemental airlines. The services complement FAA's inspection function, Gen. Kelly said, and Imbri pointed out that in FAA representative accompanied the MATS teams that investigated the last two

times that failed to get clearance from MATS.

Until Jan. 1, contracts for shortlines (just over 90 short) commercial flight within the U. S. were the responsibility of the Military Traffic Management Agency (MTMA). On Jan. 1, however, MATS was created by the Defense Traffic Management Service (DTMS) and its executive director, Arno May, Gen. E. Sewell Myers, ordered to report to the director of the Defense Supply Agency rather than to the Secretary of the Army.

DTMS retains the old functions of MTMA. It manages group movements involving 15 or more military personnel and is concerned for all domestic flights. A significant exception to this rule is that local business concerns are exempted to be, but for groups of up to 14, and for any number of new recruits.

The 74 Army soldiers who died in the Tappan Creek were not included under this exemption.

Because housing space is scarce at most receiving centers, records bound for distant points usually were sent via air mail on an individual's pocket bag. Because individuals' families are notified with CAB by supplemental generally are lower than comparable tariffs filed by certificated route carriers, supplementals generated some of the lowest unit rates. In the past, McNamara's order isolated the net scheduled carrier from this source of revenue.

## Add to Problems

To carry out the secretary's directive, MATS and MTMA concluded a series of understanding that probably will add to the supplemental industry's monetary financial problems. First time in the agreement, both the military and commercial aircraft may be operated by military passenger charter, thus co-terminating Douglas DC-10 and DC-4 and C-119. The second new test the secretary's directive is, however, for "one-way" operations, indicating MATS may prefer that all military passengers travel either on foreigner equipment scheduled route service.

DTMS, in purchasing out primary charter business, doing directly with the operations authorized by CAB to represent the supplemental airlines. The agreement then divides business among 40 members by contracting individual airlines to the standard charter acquired by DTMS. There was no question, until last month, that supplementals were supported by the Independent Airlines Act.

After the legislation, however, some of the larger supplementals, such as IAA and Associated Military Air Carriers, Inc. On Dec. 21, MACA

## MATS Contracting

Long-term airtex contracts awarded commercial carriers during Third 1961 by Military Air Transport Service were total about \$31 million, of which \$90 million was for overseas services and \$41 million for domestic services.

Until 1962, airtex airtex contracts, actually valued at \$49 million, were scheduled to \$44 million because MATS awarded operations claims in the agreement to agree with military loadings should.

Individually selected airlines passenger traveling, airtex has been available for an additional \$18 million of air line service than for that last year. Shortline current contracts were worth around \$45 million.

Contracting covering loads, quantities, Air Defense Command units also support and include air support under the \$41 million cost to the domestic carrier. Current charges for the overall \$18 million

did for CAB appeared as an eight-month contract of American Flyers, Inc., Capital Airlines, National Air Transport, Pacific Airmobile, System Airways, Trans-World Airlines and Overseas National Airlines. The latter two former IAA carriers.

Robert Campbell said on the application, MACA changed its name to the National Air Carriers Association.

In an effort to quell the solution before the new group could gain CAB approval, IAA charged that MACA's business legally could not again from the parent association until all debts were paid in full and that the MACA airlines did not have IAA as a subsidiary. IAA's additional IAA, CAB concluded that the MACA charter was illegal because no history accompanied its flight. A full evidentiary hearing was conducted by IAA.

In an apparent rejection of IAA's charges, CAB said last week that it had examined the documents filed by the National Air Carriers Association in a preliminary review and that they appear to satisfy Board requirements. In the same action, CAB approved an understanding between the new association and DTMS, thus authorizing a second group to speak for supplementals including domestic charters.

Additional changes in military airtex policies probably will be forthcoming as a result of Defense Secretary McNamara's latest directive appointing the Secretary of the Air Force single manager of airtex movement. Purpose of this order, as explained by Deputy Assistant Defense Secretary Rife, is to ensure conformity in international and domestic procurement procedures.

Using safety and service plus the assumed early contribution to the U. S. military, the Air Force has been instructed to weigh present policies and submit change proposals. Rife told the subcommittee that he also said that at this juncture, "we can give no real advantage in having a single agency purchase all airtex required by the military."

Subcommittee chairman, Rep. Porter J. Hall (D-VA) The other two members, Rep. Robert D. Byrd (D-MD) and James E. Van Zandt (R-PA) FAA Administrator N. E. Rife, and CAB Chairman Alan S. Boyd were to testify late last week. Other members made these key points:

## Key Points

▲ **DTMS and its predecessor, MTMA,** has emphasis on FAA and CAB administration that a particular carrier is competent to operate a charter for the military. MTMA, however, Gen. Myers, lacked the staff and facilities to make such checks comparable to those conducted by MATS.

▲ **Finn G. I., 1960, to Sept. 30, 1961,** in which the military's interest was represented to MTMA by either FAA or CAB. Of the right supplemental that did the most business by MTMA during this period, MTMA noted that few, this interest one reported to it and two others on the basis of safety, not safety, according to Gen. Myers.

▲ **MTMA's** would refuse to contract with a carrier if it afforded inadequate service, but not if it utilized known aircraft. IAA's charges that MACA's business legally could not again from the parent association until all debts were paid in full and that the MACA airlines did not have IAA as a subsidiary. IAA's additional IAA, CAB concluded that the MACA charter was illegal because no history accompanied its flight. A full evidentiary hearing was conducted by IAA.

▲ **MATS' inspection of a supplemental,** if based on financial inadequacy, can be rescinded by the Small Business Administration if it deems to use a certificate of inspection. Representatives of the administration told McNamara that MATS surveys teams as they did supplemental reviews.

▲ **State supplemental airlines' membership** and financial control keeping up no doubt that MATS "was not able to complete adequate records. At times, records were so inadequate that they could not be used for reports with CAB. Gen. Kelly said, and others seemed to have discounted records."

▲ **CAB's** will be furthering as a result of Defense Secretary McNamara's latest directive appointing the Secretary of the Air Force single manager of airtex movement. Purpose of this order, as explained by Deputy Assistant Defense Secretary Rife, is to ensure conformity in international and domestic procurement procedures.

## Military Traffic Management Agency Passenger Movements in FY 1961

Military Service	No. of going movements			Passenger movement (000)		
	No. Rail	No. Bus	No. Rail	No. Rail	No. Bus	No. Rail
Army	1,056	1,519	5,771	186	168	679
Navy	119	81	94	4	4	10
Marine Corps	648	45	591	22	7	37
Air Force	603	354	990	31	8	82
Totals	4,446	1,888	10,641	250	127	755
Total group movements	16,971					
Total passenger movement	1,114,069					

# State Officials Urge Routes for Northeast

By Ward Wright

Washington-Northeast Airlines' application for permanent operating authority in the Florida market has received strong support from a New England governor and two congressmen in hearings held last week before Civil Aeronautics Board Executive Walter Brown.

In a closed session, CAB announced that a preliminary conference to limit the action of the Hughes-TWA-Northeast Control Case (AW Jan 3, p. 38) could be held on Jan. 15. However, CAB strongly urged that the Northeast Control Case and the Florida Revised Case be heard separately with no consideration of rehearing.

In the renewal case, Sen. Warren Hearnes (R-N.H.), led off testimony in case groups and in joint sessions with an appeal to CAB to consider renewal of Northeast Florida authority in the light of its effect on New England regional transportation.

Sen. Cohen said that the airline industry in the northeast New England area was prosperous and that no airline other than Northeast had offered to provide adequate service in that region. Unless Northeast's Florida operating authority were renewed, Sen. Cohen said, he saw little hope for the airline's ability to continue adequate service in Vermont. Rep. Clifford G. Mitchell (D-Me.) said that failure to renew Northeast's Florida authority would harm regional air transportation in Maine.

## Appeal from Governors

Gov. John H. Reel of Maine, speaking for an association of New England governors, and that group on Nov. 10 passed a resolution supporting Northeast's application for permanent Florida authority, and asking CAB to take action to establish adequate air service in New England.

Gov. Reel said he felt the New England area should be served by an established airline with direct routes to the South.

Northeast, currently in deep financial trouble, must have renewal of its Florida operating authority if it is to survive as an independent carrier. In 1956, when Northeast received temporary authorization to operate between East Coast ports and Florida, it was receiving subsidies. Since then, airlines have placed \$90 million into the company. While Northeast is now off subsidy, largely due to its Florida operations, it has never made a profit. In the meantime, Northeast says it has had a twofold increase in revenue

passenger miles and has claim to approximately 25% of the East Coast-Florida market. But failure to get permanent operating authority in the Florida market would probably spell the end for Northeast, even with the offer of financial assistance from Hughes-TWA.

## Local Conditions

Hughes-TWA had said it would build Northeast 51 million, under a revolving credit plan, until May 15 to keep it operating while CAB settles the question of whether it would be in the public interest for the two companies to control the airline. However, the two companies on Northeast's proposal are reluctant to postpone their private financial commitments.

Conditions haven't agreed to settle a settlement last week.

After May 15 if CAB has not settled the case of CAB rules against Hughes-TWA's controlling Northeast, then the airline will be an airless financially. That it cannot do without its Florida routes.

Proceeding with the renewal case without waiting for the control case to be settled has created undesirable rumors of loss almost of routes. Both National Airlines and CAA's Bureau General had asked the committee in the renewal case to reconsider but discuss

not to delay the case until the renewal case was settled. Both airlines were denied.

Bureau General last week asked the committee to hold a final conference of all parties in the Hughes-TWA-Northeast Control Case, the Hughes-TWA-Airline Northeast Possible Coaches Control Case and the New York-Florida Regional Case to determine if, under all the circumstances, the public interest and determine that the control case be suspended into the renewal case.

In the Hughes-TWA-Airline Northeast Case, Harold Hughes was ordered to put his airline stock in a voting trust act to expire Jan. 31, at which time he was to have sold it. Since then, Hughes had asked repeated postponement of the deadline until late November when CAB delivered the ruling until the Northeast Control Case is settled.

## Hughes' Appearance Opposed

In other action concerning Northeast and Hughes-TWA, both companies strongly opposed Eastern Air Lines' attempt to appoint Harold Hughes as chairman of the board of directors.

Both companies said Eastern had failed to establish the credentials of good cause and sufficient support needed to justify taking of directors.

Hughes-TWA and that part of the administration have refused to pay Hughes about six thousand, as 1% of CAB and the two companies still answered was "unsubstantiated, speculative or irrelevant." Hughes-TWA described the appointment of Hughes as a "strategic designed to outbid."

Finally, by capitalizing upon Northeast's long-term reluctance to make public appearances.

Hughes-TWA said to subpoena Hughes would be an attempt to harass Hughes because in control or in a position to control Eastern, such as the Rockefeller, to justify appointing Eastern Air Lines' stock in the Northeast case.

## Not Directly Involved

Hughes-TWA said that Eastern's interests were no more or less than that of any other party. The fact company said CAB in accordance with Eastern is not directly involved in the transactions between it and Northeast. Eastern, Hughes-TWA and, was named party to the proceeding in order to be, heard as the issues but should not be allowed to become an adversary party by allowing the airline to discontinue Hughes.



Convair Delivers First 990 Transport to American

First of American Airlines' 15-plane order for Convair 990 off-includes general transport was delivered recently. Aircraft will operate in San Diego for training purposes. Second 990, which will be delivered shortly, will be flown to Tulsa, Okla., and then to New York, where local defense contractors will be contacted. Both of the 990s are scheduled for passenger service but American will utilize the aircraft in a comprehensive transportation program before introducing the 990s into scheduled operations later this year.

# Local Service Airline Profits Set Record

Washington-Louis airline set industry's new record and net income for 1961. The airline reported profit to meet of the current but was only one of the industry's total expected net profit \$2 million below. Civil Aeronautics Board predicted.

Earnings at the 15 local airlines are:

Washington-Louis airline set industry's new record and net income for 1961 to a 58.6 million operating profit, on the basis of a preliminary study of the current operating results for 11 months of 1961 and an estimate of the final month. Substantially previous, which the Board estimated last February, were total

north \$55 million are reported to amount to \$62 million.

At last few of the airlines, Milwaukee, North Central, Southern and West Coast-airline are expected to take part in the financial profit during previous under which a percentage of operating profits at different levels are returned to the Board. Operating losses of these carriers in 1960 totaled \$595,193 for Milwaukee, \$1,125,708 for North Central, \$14,900 for Clark and \$625,900 for Southern. West Coast had a \$70,000 operating profit for last year, as compared with an operating profit of \$1,195,000 under the new rate of 1961.

A final year-end adjustment to these figures by CAB within the next two months, could change the apparent operating profit but it is doubtful that any change would be significant since the carriers are generally adhering closely to CAB's rules on the formula, a Board spokesman said. One of the major reasons, he pointed out, is that disbursement provisions, which had a severe effect on the airlines under the previous cost rate formula, have been completely nullified out to avoid any disagreements.

The data and rate, designed to be precise, highly complex and easily misused formula previously used, in con-

## Local Service Operating Results—1961

Airline	Profitability in thousands of dollars		Total	
	Estimated	Actual	Operating	Operating
Delta	14,308	4,327	30,103	30,103
Eastern	2,850	2,814	8,304	8,310
General	4,344	3,879	8,054	7,808
Republic	8,001	6,956	14,827	14,119
United	9,937	9,917	9,828	9,248
Western	16,426	4,335	18,719	17,457
North Central	16,816	6,966	22,244	24,084
South	5,621	4,191	12,342	10,459
Pacific	7,796	3,912	11,128	10,120
Piedmont	5,301	4,801	13,810	10,806
Southern	6,400	6,211	10,431	10,407
Northwest	6,866	6,865	10,071	9,818
West Coast	7,811	5,208	10,299	10,985
Totals	114,742	45,723	177,445	167,844

Source: Ray and Ray (based on 11-month figures with 12th month estimated)



# Larger, Tougher Florida Market Foreseen

New York-Los Angeles traffic has been the Florida tourist market will see some major competitive developments in the next season.

• **Service of Northeast Airlines**, at first thought the winter operation likely won't fly higher fuel has prompted up the carrier's forecast position. Whereas Eastern and National had hoped that Northeast would bid thousands and be out of the Florida picture, the carrier is now saying that Northeast will be competing in the bid, but it's unlikely in the winter. Northeast will experience its first full season with Constellation 880 jets which due to financing delays, did not arrive in full strength until late in the season last year.

• **Cancellation of Eastern's jet expansion** will strengthen after the failure of power in the market. Eastern suffered a relative surplus of jet equipment last season. With additional cancellations, the airline is coming back strong with an almost tripled jet capacity in the next year.

• **Merge of Eastern and Capital** parts the nation's largest airline in Florida winter for the first time. The combined carrier joins with Capital's former routes to Florida and is scheduling large increases of jets.

The airline report is unprecedented in the Florida market this winter and bodes a poor season last year where

traffic showed a slump in the face of increased jet competition and capacity. On the basis of reported increases in load and recent bookings and an opinion in the general consensus, the carrier is predicting a good increase in Florida market traffic. But there will be increasingly heavy competition for the traffic.

Last year's poor season was illustrated in Miami originating figures for all airlines. For the first six months of 1963, these originations totaled 5,659 less than during the prior six like period. The first quarter-plus of the winter season showed the worst results. There was some improvement in the second quarter and the year month total was off only 23%.

## Miami Weather

Recent sporadic cold weather at Miami has brought some bad publicity which didn't get the season off to a good start but airline men here have reflected on traffic and they predict that a run of good weather will make possible a record season.

Following Eastern's lead, Northeast and National have announced operations of their south-to-flight in the Florida market. Eastern in 1960 suspended this type of service, designed to be

competitive with earlier bus transportation. Between Pittsburgh and Miami with Super Constellation equipment and has been extended to Detroit, New York, Cleveland, St. Louis, Denver, Boston and Philadelphia. In this service, the passenger's ticket is by reservation and is not refundable less than 24 hr before departure. Eastern calls this service "Airbus National cities to Star Line" and Northeast calls it "Southern Bus National" name. It operates DC-7Bs will operate from Miami plus continuing to Miami, from Boston to Miami via Washington and West Palm Beach and from Las Vegas to Miami via Las Vegas. Northeast's bus operation will be confined to a single round trip twice a week between Boston and Miami via Tampa, using "F" passenger DC-6Bs.

There is a possibility of seven airlines' service in Florida this winter from the Northeast and Midwest.

• **Delta** will operate 18 daily jet flights from Detroit, Cincinnati and Chicago to Florida with a total of 1,112 seats. In addition, Delta will operate seven DC-7 and DC-8 flights each week. Delta's fleet will have increased at Cincinnati and Chicago. Equipment in DC-8s and 740s. Delta was the airline, this season is more optimistic, possibly because of reports of economic conditions, particularly in the Detroit area where automobile plants are in full operation.

• **Futura**, a jet and turboprop will be operating 20 round trips a day with one DC-8 and 720 jets between Florida and the Northeast and Midwest. This compares with a total of 31 jet round trips last February, when the airline's jet fleet consisted of 11 DC-8s, seven turboprops and 15 DC-8s and 15-720s. Between New York and Miami, Eastern last February operated four jet round trips. This season's total is 38. From Chicago, jet flights to Florida will fly from two to five times a week and seven times a week to Miami from Boston, Pittsburgh, Cleveland and Baltimore. In addition to these and other jet expansions in the market, Eastern will continue to operate winter equipment to total capacity will be considerably increased. If traffic does pick up this winter, Eastern will be in a better position as its fleet has been cut down than it would have been last season when flights were slower. Eastern's winter jet fleet expansion for the first six months of 1963 was 47%, down from about 55% in 1958. But Eastern expects to come back at least to the 1958 level this winter. The outlook of Miami originations of comes, in addition, traffic will be increased by the jet to the Northeast and Midwest. North

east Airlines claims to account about 25% of passengers traveling to Florida from the Northeast jet fleet and will increase in the winter of 1963.

• **National's jet operation in the market** will be confined to New York-Miami route with five daily DC-8 round trips, some at last year. Jet seats will be down 10%, however, due to changes in equipment. But capacity, including the jet and piston seats, will be up in all National's northeast markets to Florida up 6% in New York, up 40% in Boston, up 75% at Philadelphia, and up 18% at Washington. These increased capacity to peak winter month seats from the points to all Florida points. Connecting en-passant for the season, National will there certainly will be some capacity left over available from the North to Florida this winter. The airline will continue to suffer. National said "from the market and no economic operation" at Northeast in the market. National will Eastern could use the loads to the Northeast on services in the market. National said:

• **Northeast** will offer more than 2,100 daily jet seats in its Constellation 880s that started a 40% increase over the jet seats it started in the previous season. Last year it was down 10% in its 880s and it was March before the carrier fleet of six was operating in the market. In addition, the airline's DC-8s will serve Florida. Northeast predicts record-breaking traffic this winter, especially excellent indications from local and travel interests in Florida and a large volume of advance bookings on Northeast flights. Northeast is strongly advertising package vacations in Florida. Beginning its featured sales to complete this winter, whenever the North can have a credible advertising campaign a sign that risk is in the air.

• **Northeast** will not fly to Florida this winter but will not fly to Florida this winter because of strikes which will up its operations. No service to Florida was offered last January and February. But the airline, Northeast will be operating jet flights to Miami from Chicago to Florida, plus two Eastern subsidiaries. Only one of these flights, a jet which will operate nonstop to Miami from Boston and that only three times a week. It will stop at St. Petersburg the other four days.

• **Trans World Airlines** will operate a daily 787-120 nonstop between St. Louis and Miami, plus a Super G Constellation with stops between the points. This is less capacity than TWA operated last winter. The airline made a good thing out of this route a couple of years ago offering single plane service from Miami to Los Angeles via St. Louis. Civil Aeronautics Board, however, ended this route because of a change of planes as well as flight times in St. Louis.

## MATS Reports Low 1961 Accident Rate

Washington-Military Air Transport Service said its 1961 flight safety record was the best in nine years since the Corps started operations and a heavy schedule of public flights.

MATS said in 1961 accident rate was 1.85 per 100,000 hr. of flying time. The 1960 rate was 2.47.

The MATS figure included the operations of its Air Service Squadron, which can amphibious and landings in addition to conventional airports. The work of MATS Air Photographic and Charting Service and the Air Weather Service was also included.

MATS carries 51 types of aircraft totaling 1,561 planes in flight equipment including 125 C-119s and 100 C-124s. The heaviest transport aircraft was the C-124 equipped with an engine in 1960. This aircraft of all types were involved in major accidents in 1961 equipped with 13 in 1960.

The last fatalities since December 1955 were recorded last year when a C-124 Chetani crashed into Tacoma, Wash., killing 12 passengers and 5 crew members and a C-119 disappeared, took 13 passengers and 16 crew members on a flight over the North Atlantic.

United's efforts on the former Capital route to Florida are aimed at getting around the equipment placed in the market and as fast as possible. United also has scheduled increasing Capital flights with the idea of providing service at more convenient hours for the tourists. United describes its approach generally as "the airline's 1961 winter season equipment and a more realistic attitude toward scheduling. Capital's jet equipment in the market last winter consisted of two Boeing 720s leased from Eastern. United now is using Constellation and 720s in Florida service as well as DC-8 equipment. From Pittsburgh, United has 145 daily seats of which 211 are in jet, less than Capital's 242 seats, of which 166 were in jets. While the airline's total capacity in United points to a good increase in jet service and schedules at better hours. From Cleveland, 351 seats are scheduled this winter with 373 of those jet but as the total was 352 seats of which 155 were jet. From Buffalo, United offers only one flight, a 727-operated DC-8 coach to Tampa and Miami compared with jet flights and 373 seats, off from the total seats in the market. But United points out that excellent connections are offered from Buffalo to jets at Pittsburgh — 110 — which is selling at Buffalo. Jets do not operate at Buffalo. United said Florida business and traffic is good with traffic pickup earlier this winter than last.

• **Trans World Airlines** will operate a daily 787-120 nonstop between St. Louis and Miami, plus a Super G Constellation with stops between the points. This is less capacity than TWA operated last winter. The airline made a good thing out of this route a couple of years ago offering single plane service from Miami to Los Angeles via St. Louis. Civil Aeronautics Board, however, ended this route because of a change of planes as well as flight times in St. Louis.

## British Pilot-Time Plan Based on 'Points'

London-Air Ministry sources here have submitted proposals for a new system for airline pilots, based on a variable flight hours, to replace the monthly flight hour limitations. A preliminary report says a long study by British, European, American, National Joint Council for Civil Aviation and the British Air Line Pilots' Assn.

The study started six months ago when previous safety concerns risk flight hours. ICAO, the International Council, United Nations and Washington. The report contends that, as difficult new stress factors for different types of aircraft. The present position also would make a more difficult winter season, with flying months, less hours.



Glass-Domed Trains Operate at Los Angeles Airport

Three two-car glass-domed trains capable of carrying 60 passengers operate monthly, once a week to Los Angeles International Airport's new terminal. Trains come, stop trips between terminal's various arrival facilities at 10-minute intervals. Five to 20 jets per person. Passengers board trains at sidewalk level through electrically controlled glass-domed train. A quick access luggage compartment is located on boarding side of each train with, with seating on opposite side and at either end of each train. Trains, which are built by the Fairchild Transit Equipment Co., Los Angeles are operated by Airport Transit, which provides color of historic Theme Building in background.





# BRITISH ARMY CHOOSES VIGILANT

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## Airline Traffic—November, 1961

	Domestic Passengers	Revenue Passenger Miles (RPM)	Passenger Load Factor %	U.S. Mail Ton Miles	Express Ton Miles	Freight Ton Miles	Total Revenue Ton Miles	Over All Revenue Load Factor
<b>DOMESTIC TRUNKS</b>								
American	871,459	493,745	57.7	3,450,535	1,343,791	12,036,256	16,830,582	52.5
Delta	795,229	572,788	56.8	4,511,229	2,044,272	1,884,496	10,711,422	45.6
Continental	520,661	377,284	49.8	2,293,524	1,294,891	4,259,813	7,912,246	58.0
Delta	391,697	181,351	36.9	3,641,647	382,283	1,749,350	5,773,280	49.8
Eastern	477,549	329,195	45.5	1,961,261	387,968	2,543,308	4,892,537	37.3
Northeast	544,270	302,345	48.9	423,380	103,245	1,352,230	1,978,855	45.3
Northeast*	320,942	31,321	44.9	---	---	---	---	---
North West	544,247	37,720	46.1	633,774	282,333	1,344,555	1,960,652	45.6
Texas & West	320,345	334,071	48.3	3,991,205	483,272	5,646,871	10,121,348	47.3
United	626,875	341,820	51.2	3,979,007	1,317,158	9,883,318	15,180,483	46.7
Western	542,459	79,312	45.0	329,243	189,374	368,822	6,927,441	29.9
<b>INTERNATIONAL</b>								
American	7,512	7,692	48.4	5,276	---	232,883	9,821,724	52.5
Delta	7,426	10,650	46.7	56,997	---	218,512	3,289,877	41.6
Continental	37,082	2,375	49.9	2,944	---	14,811	299,631	46.4
Delta	1,676	1,081	21.9	1,204	---	7,421	123,990	21.2
Eastern	30,150	47,265	59.4	134,601	4,610	395,340	4,778,486	53.3
Northwest	14,092	25,158	48.1	1,913,046	6,002	192,650	3,419,390	50.9
Pan American	---	---	---	---	---	---	---	---
Alaska	3,028	2,981	29.6	42,525	3,429	204,458	544,094	26.8
Athens	116,757	182,884	42.7	3,351,110	---	6,897,247	13,478,735	45.4
Latin America	103,467	133,200	39.6	344,482	15,380	5,127,817	10,229,004	41.9
Pacific	37,874	153,560	48.4	3,371,141	15,525	3,990,779	23,340,260	58.5
Europe	11,186	25,139	48.3	1,612,993	---	841,932	3,140,491	43.6
South Pacific	111	354	24.3	2,217	---	719	33,383	29.2
Texas & West	18,126	54,951	45.3	1,921,538	---	2,406,202	14,474,720	53.0
United	13,229	27,962	45.7	2,084,615	8,268	20,142	3,443,677	42.1
Western	9,737	8,932	48.4	9,467	---	28,781	949,448	33.8
<b>LOCAL SERVICE</b>								
Allegany	72,754	15,261	48.6	26,035	49,089	67,899	1,629,132	49.8
Boeing	26,771	7,161	16.2	4,771	---	1,982,715	1,982,715	61.4
Continental	24,150	4,889	22.4	17,738	8,243	26,443	322,437	36.0
Eastern	26,297	7,730	36.7	21,871	11,034	48,483	642,369	40.1
Delta	11,176	24,638	58.9	23,783	2,783	616,384	616,384	40.1
Delta Central	34,987	14,879	45.0	29,929	34,987	31,611	3,223,324	44.0
Northwest	74,650	12,485	45.3	62,964	53,941	1,448,008	1,448,008	42.9
Overseas	48,468	9,855	43.4	21,683	32,179	48,272	558,485	45.2
Pacific	34,321	8,457	38.8	37,124	9,482	18,180	838,928	51.4
Pacific	43,352	9,136	48.4	16,286	20,879	38,924	146,923	48.4
Southwest	21,458	1,494	26.4	24,815	16,154	36,812	671,203	70.1
Texas & West	4,833	6,872	45.0	20,538	6,872	48,938	117,437	39.3
West Coast	30,145	7,323	41.7	14,344	4,843	18,794	737,484	43.0
<b>HAWAIIAN LINES</b>								
Alaska	23,484	3,257	33.9	2,733	---	4,615	279,074	48.9
Overseas	20,539	4,543	52.4	4,426	---	143,074	313,243	55.1
<b>CARGO LINES</b>								
American	---	---	---	---	---	---	---	---
Boeing	183	422	58.4	56,181	20,794	261,267	341,267	71.0
Continental	---	---	---	---	---	---	---	---
Delta	---	---	---	---	---	---	---	---
Eastern	---	---	---	---	---	---	---	---
Northwest	---	---	---	---	---	---	---	---
Overseas	---	---	---	---	---	---	---	---
Pacific	---	---	---	---	---	---	---	---
Southwest	---	---	---	---	---	---	---	---
Texas & West	---	---	---	---	---	---	---	---
West Coast	---	---	---	---	---	---	---	---
<b>HELICOPTER LINES</b>								
Chicago Helicopters	17,084	295	47.4	1,817	---	---	29,911	26.9
Delta Helicopters	31,569	4,569	58.9	2,487	---	---	32,276	41.1
Delta Helicopters	12,355	265	54.7	1,444	1,005	473	26,207	31.7
<b>ALASKA LINES</b>								
Alaska Airlines	3,021	4,123	33.8	62,656	1,360	319,378	1,081,212	54.2
Alaska Central	3,945	815	52.4	4,734	---	5,715	44,734	44.8
Continental	1,561	228	48.8	6,878	---	19,720	47,853	54.2
Delta	3,325	189	47.7	1,864	---	1,832	25,112	58.6
Delta	1,328	31	3.7	467	---	725	6,445	48.7
Northwest	3,368	489	29.9	99,438	---	42,634	174,733	39.3
Pacific Northwest	7,481	6,233	33.8	167,708	9,434	298,384	1,235,155	54.0
Southwest	1,714	174	42.0	1,714	---	86,342	21,563	56.8
Western Alaska	1,714	174	42.0	1,714	---	1,714	4,242	54.0
West & Alaska	3,720	635	29.6	37,192	---	131,421	268,122	52.7
Alaska	3,223	174	50.0	323	---	219	17,351	52.3

\* Northeast figures not available. Includes Alaska Express.  
Figures for Memphis, Tri-City, Dallas, Dallas, Dallas and New York are not available.

Compiled by AVIATION WEEK from statistics supplied by the Civil Aeronautics Board



## Scott put the **LIFEGUARD** on the B-52



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ASP 413 layout for low-wing aircraft is based on Army reconnaissance and surveillance mission. Gross weight is 11,200 lb.

## GE Projecting Lift-Fan Aircraft Designs

By David A. Anderson

**Brendak, Okla.**—Design projections of airplanes built around General Electric's lift-fan propulsion system moved closer to reality with the company's latest contract award to Ryan Air International Co. for construction of a full-scale flight research vehicle.

Engineers in GE's Flight Propulsion

Laboratory Division have also been working on the development of the lift-fan system, have provided that work with a series of aircraft layouts using lift-fans. Their studies have ranged over the various spaceman flow plan, support of ground forces to medium range, conventional transports. In sum, the designs have started at 6,000 lb. gross weight and gone upward from there.

Such design studies are not unique with GE. In the past, such studies into the field of jet propulsion spent sizable amounts of time and money on layouts of aircraft to use their unconventional new engines. More recently, the development of lifting propulsion systems for VTOL aircraft have prompted design work to meet proposed mission requirements for at least two reasons. They must be able to take out arm of missions that can be better accomplished with these systems, and they must be extremely so many of the development problems as possible well in advance of actual construction.

### Typical Studies

Two series of military aircraft proposals show typical studies made in the division to study relation requirements or typical missions. None of these is offered as the final form for an aircraft, there are too many steps between proposal and construction which can affect the aerodynamic structural and propulsion characteristics that GE believes these layouts represent aircraft designs that could be built and would perform close to specifications. In all cases, layouts have been made in enough detail to do the usual proposal calculations of weight and balance, performance, and stability, and control.

GE's lift-fan propulsion system uses a gas generator to drive a large-diameter lifting fan for vertical thrust during the takeoff and landing modes. A diverter valve directs the gas generator exhaust

through a conventional nozzle for the forward flight regime.

Major advantage claimed by GE for the system is the lift-thrust ratio. The fan gives a vertical lift which is about three times the thrust of the basic engine in horizontal flight.

Designs based as a study contract by the U.S. Army during 1977 and 1978, the lift-fan system has been tested as a full-scale prototype on the company's test stand and in the 40 x 60 ft full-scale tunnel of the National Aeronautics and Space Administration's Ames Research Center. Both series of tests were also funded by Army at just as a 1978 contract to establish the feasibility of the lift-fan system.

### Research Aircraft

Most recently, GE awarded an initial \$6.9 million to Ryan for the design and construction of a research aircraft to be powered by a pair of 6-ft dia. lift fans located in the wing. Although this is to be a test aircraft, several of its features are the lift-fan system under full-scale flight conditions, the Ryan-GE design could well be the starting point for growth into an aircraft to meet the Army's wanted surveillance mission.

Two of the GE aircraft layouts are based on the performance of the Army's mission in surveillance and reconnaissance. Such a mission requires penetration of enemy defenses of low altitudes and high maneuverability for accurate observation. Interchangeable, self-contained pods could carry specific equipment—radio, photographic or infrared surveillance gear, for example—for specific missions within this framework.

Alternate installation of target acquisition and fire-control equipment with surveillance and communications pods added, would give the airplane its reconnaissance capability. Finally, the airplane could be armed to attack targets of opportunity.

First design study—ASP 410—on this category featured two fans in the fuselage, using test data from the Ames full-scale tunnel. The aircraft would weigh approximately 20,000 lb. Over all length is 45 ft, wingspan is 31 ft, and height is 13 ft. Each engine is driven from a fan installed in an extension of the tail structure, and each engine is handled by wingtip control surfaces.

Second design study—ASP 413—uses a better approach to the same mission and is almost one-quarter lighter than

its first proposal. ASP 413, 11,200 lb. (gross) now, has two wing fans, with a pitch fan in the nose for longitudinal control.

This design is estimated to have a sea-level top speed of Mach 0.9, and a VTOL mission radius of action of 710 miles, an order-of-magnitude increase.

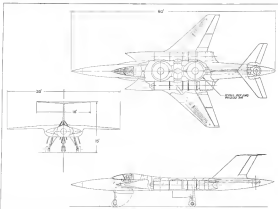
A fuel load of 400 lb. under the starboard wing could be balanced by a Starlin GAN 33A Bellingsport aircraft carrier under the port wing. In addition, the drawing shows the outline of a sub-linking main structure under the leading structure.

### Search and Retrieval

Current Air Force requirements for a search and retrieval aircraft, outlined in SRS 157, has been studied as a "mother-daughter" concept by contractors participating in the competition. The base version calls for operations over a 1,000-mile radius, using an aircraft of the Lockheed C-119 type as the mother plane. Mother and daughter take off separately, hook up in the air, and cruise at 240 kt. at penetration altitude out to the 1,000-mile radius. At that point the conversion begins for four hours at 16,000 ft. Then the daughter plane disengages



ASP 410 is proposed to meet requirements for search and retrieval aircraft.



FIGHTER/BOMBER POD/FAN features fan-fan lift-fan installation, was developed around NAEI requirements.

# ITSELF! ITSELF!

BY JIMMY HODG

Itself, king of the Philippine Deep-sea, was a common name for the ten pools down on a small island from his exchange period, and looked around hesitantly. The Alter Ego said, "Well, here is it with itself today."

The Alter Ego was a booster, a power-station to assist and in his head was a computer.

Itself did not answer. During the deep period, he had drifted over a mine, the walls of which dropped simply another thousand feet. Suddenly itself glared along the canyon rim.

Not a vast observation. No light ever penetrated from above into the eternal night here at the deepest borders of the ocean. Itself perceived the black world as both surrounded here, with high frequency sounds which he heard as continuous in all directions. Like a bee in a pack dark cave he realized the voracity of the things in his water, aware by interpreting the returning waves. And the accompanying evidence of suspicion was a device which expelled itself to avoid changing pressure, tem-



peratures and current flows. Unknown to Itself, what he observed became part of the ancient, total of itself, but which computers for every encounter the water, releasing of ocean and atmosphere, and that produced waves and air in individual everywhere with sensory evidence.

He was almost perfect perception. Clearly and unmistakably itself made out the outside in the far distance of itself, seeing never. A ship? Anchored as such in the very edge of the canyon?

The Alter Ego said, "You're not going to let somebody invade your territory, are you?"

Itself, itself was known. He activated the jet mechanism in the underbelly, belly of his almost solid metal body. In a flash, a nuclear reactor heated the plates of the ship's chamber. The water, which flowed through the chamber, burst into boiling clouds of steam, and he pined forward into a new life.

Arrived at the ship, itself reached the arena of four anchor lines with the reactor-powered heat beam in his hand. When he had leveled a beam in the second cable, and himself through it. Then he headed for the third cable.

But the startled beings around the ship had spotted the twenty-foot member in the black water below.

"Another in the garden," cried the command. That was alone, with solid steel.

"Feed the pattern back through the infinite slanting system of the recorder, repeat a response."

The significant response was itself, forgot what he was doing. He was doing, himself away, when his Alter Ego said, "Wait up!" You're not going to let them get away with that, are you?"

The device had perceived itself as a more intense level of light. He became a nucleus, more sensitive. Now he simply moved out the ship, not open.

The new glider again triggered a second warning.

Itself's echo system of perception, normally more used to the safe for all living things in the sea, suddenly strengthened. It became a separate beam. Purposefully, itself moved towards the ship.

Watching his approach, the device decided to take no chances. Pull the maining, suddenly and.

Itself, itself thought for the center part of the vessel. Instantly, those ultrasonic waves started a rhythmic vibration in the hand wall, awakening it.

The metal passed under a weight of water that at these depths was thousands of tons a square inch. The water wall backed with a mobile something.

The water wall leant, he held. At this point, the applied defense got a power vibration, started, solidified the rhythm of itself's presence, and was safe.

But it was a much wounded ship that now drifted helplessly in a slow current.

The device had so far used no energy that might be drained from the surface. But they had come to earth to establish a base for action. Their construction work was accurate, though data about underwater currents, to enable them to leave the deep, and eventually to be able to drift over land, through their senses, and drift away again. But this purpose they were quickly aware, and they refused to let it be their black water without a fight.

"What can we do with that device?" "What if?" someone said.

"That's dangerous!" the cautious leader.

"We can't be in greater danger than we already are."

True, said the captain, "but frankly I don't know why he's armed at all, and I don't believe he has anything new." His command when it came back a return.

"Set up a response system. If he does attack with anything new, it will automatically fire back. We'll make that much of a chance."

The second attack had driven itself completely berserk. He raised his nuclear pellet gun, and fired twice. The next shot was a blast from the broader part of his beam.

The Alter Ego said, "You're not going to let them get away with that, are you?"

But the king of the Philippine Deep was alone, and could not be guided.

In due course there came a report to another headquarters.

"Carpenter Center shows no current data from itself. In therefore shows as if another of the set-back, undisturbed water-surface system has been set. You may recall that these electronic monitors were programmed to recognize, signal, and the data that they would pull off the ocean. After the war we could never get their members to surface; they were too suspicious of us."

The water, it was, like the ocean of us for shores, flowed and rolled and moved, a constant, dynamic, undisturbed motion, only, many times more powerful, however, than any conceivable air current. Yet it moved the boundaries of water, movement safety and easy but, second their way.

Though the Philippine Deep there began presently to fire an enormous ball, moving forward. It carried the sound round in a long, slanting upward direction, but it was many weeks before the drifting ship slowly broke surface, and neither ship or its helmsman was seen.

A final point showed a final, alone, deep more than a month from construction, and after maintaining the device, currently analyzed what had happened. And so—

A new language, to the first "day" of his design, and heard the Alter Ego say, "Well, itself, what's the program?"

Itself glared with a royal suspicion. (Itself now like your new jacket made of itself.) (See column at right)

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And, even though we haven't come up with the rest (ITSELF, we've have succeeded in producing a complete packet could be designed to help you make up your mind when to jump with them, once they're there. If you'd like one of our best men of the normal device, write Military Products Div., 1344 South 108 St., Los Angeles 26, California.



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# MARLIN-ROCKWELL RELIABILITY COUNTS IN THE HEART OF THE



North America's X-15 powered by Thosco's LR33 rocket engine shown below on display stand



MRC SHIMLING STEEL BEARINGS used in the main pumps of X-15's liquid fueled rocket engine have contributed to the phenomenal success of this famous aircraft which has far exceeded test expectations.



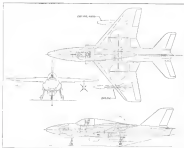
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ASP 410 was first design study to study inner structure of recombinant and overpressure



ASP 410 is smaller and lighter version meeting same requirements as ASP 400.

and lets down to set level where it conducts a 90-mph turn or takes at a maximum speed of 140 kts. followed by 10-mph lowering during which the aircraft remains in a selected. The daughter then climbs out to ascend and develop with the mother C-119 and the combination crosses back at 140 kts and proceeds to altitude.

GE's study ASP 410 is based on the current leadership of the X-15's 15 kts. far in there, using two of them in a wing installation. Can generator meet in a part of recombinant 15 kts. The aircraft weighs 13,160 lb. gross, and can sustain a overload of up to 3,600 lb. C-119 is 14,775 lb. long by 53.1 ft. high by 5 ft. wide.

Wingman of the ASP 410 design is 45.83 ft. Overall length is 43.35 ft. and height is 12 ft.

GE's study design could also serve the Army as a general utility aircraft for home medical evacuation or support. Without its mother plane, in operating modes in 200 mph.

Smallest aircraft in the series studied is a drop weapon aircraft to be attached to combat units. It was a single 155-gal. capacity in the fuselage, driving two wing fins. Weight of the aircraft is 4,000 lb. and it can carry up to 500 lb. (about equal to two B-100) of re-surface weapons or other armament. Performance is about one hour.

Wingman is 20 ft. long, 10 ft. h.



## PUMP PRIMERS ARTHUR A. NICHOLS

### HOW A PUMP CAN SERVE SEVERAL SYSTEMS

1. Engine designers have been recently strongly attracted by German pumps which permit the incorporation of an entire pumping stream in a separate chamber of the fuel-injection pump to provide fluid pressure for a control function or other use.

2. The German is a form of internal pressure pump consisting of only two main parts: an inlet feeding element and an outlet, making isolated element. The latter element has one less tooth than the inlet and the "driving tooth" provides a means to force the fluid from the inlet part to the outlet. Pump capacity is measured by the volume of the "driving tooth" multiplied by the number of driver teeth and RPM.

FIG. 1

3. The engine manufacturer of the German type pump permits internal systems designers to combine several pumping functions in a single pump housing mounted on a single pad and driven by a single shaft. Controlled systems such as fuel-injection, the low pressure hydraulic servo system and meters up to pressures of about 1,000 psi may be controlled in this manner.



FIG. 2

4. The designer has several variables to secure a given capacity within his space. Intermediate former diameter which governs the area of the pumping chamber. Variable diameter bush, taken with area decreases chamber volume and restricts flow. This is possible to vary the diameter, length and speed to secure the needed capacity.

5. The German pump is a positive displacement type of pump in driven component is rigid. It is simple and compact in basic design. It is light-weight, vibration, performs exceptional performance at high altitudes and has low space index a long service life. In addition, it is balanced and extremely quiet in operation.

6. Technical data is available and your inquiry is invited. Write:

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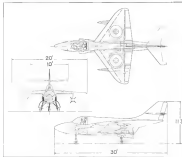
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ASP 012 is designed to meet NATO fighter bomber requirements for VTOL, stealth



SMALLEST DESIGN weighs 6,000 lb.—was planned in Army close-support aircraft

and length of the aircraft a 31.2 ft. GE's designers have detailed two new proposals built around various prices for lighter bombers. Both of these are expensive VTOL aircraft, and both of them are in the class of designs which met the NATO specifications contest in April 1981 for fighter bombers. Says that same NATO thinking has changed somewhat so that in detail these proposals can not exactly match current requirements. But they do serve the useful purpose of indicating the use and performance potential of an aircraft designed to the specifications.

First of these designs has a super-fine resemblance in shape and size to

the Republic F-105 series, but weighs in at a considerable lighter 27,000 lb. gross weight. These are two 5-ft-dia. (ft) fans in the fuselage, driven by unspecified gas generators which could be basically GE J79 turbojets. For pitch control, a small fan is mounted in an extension of the tail structure. Roll control would be handled by section controls at the wing tip, fed by air bled from the gas generators. Length of proposed design is 60.35 ft, span, 35.31 ft, height to top of tail in transport position, 18.35 ft.

Second of these proposals is ASP 003, a two-engine configuration with a low aspect ratio delta wing. The two

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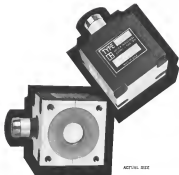
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Flament Voltage	6.3 volts	6.3 volts	6.3 volts
Flament Current	3 amps	3 amps	6 amps
Anode Voltage	1400 volts	1300 volts	1750 volts
Anode Current	2.2 amps	1.8 amps	1.8 amps
Maximum Duty	0.05	0.1	0.1
Pulse Length	92 to 3 $\mu$ sec	62 to 3 $\mu$ sec	62 to 3 $\mu$ sec
Size	1 1/4" cube	1 1/4" cube	2" cube
Weight	6 ounces	8 ounces	16 ounces

comparative-type position to be the 170° or an equivalent ion generator drive four 180° turn points on the wing root. A pitch fin is located in a mid-forward position in the fuselage and there are wing root air ducts. Gross weight of the proposed design is 20,400 lb. and the ratio of carried lift to gross weight is approximately 1.09. This corresponds to a lift lift for the VTOL mode of 30,800 lb.

### Bulged Wing

The 170° span wing is bulged at the root to take the lift load installation. This geometrically thick section becomes effectively an semi-circular then, 45° axial because of the air flow into the lift load section. Wing aspect ratio is 1.9. The effective wing area is 770 sq ft. at that wing loading at actual gross weight is 79.5 psf.

Overall length of the design is 65 ft and height to the top of the tail is 17 ft.

Performance is calculated as super sonic with a maximum speed of Mach 2.1 at 34,000 ft altitude. Initial rate of climb is estimated at 42,000 ft/min. Fuelled on a typical mission is 1,500 lb.

Normal fuel load is 9,405 lb., but extended fuel can be carried up to a maximum of 20,000 lb.

### PRODUCTION BRIEFING

Western Electric Co., Inc., has received a \$1.8 million Army contract for additional production of guidance and control equipment for the Nike Hercules anti-aircraft missile.

Aircraft Division of Aerojet-General has been selected by the AFSC/NASA Space Nuclear Propulsion Office as investigator, architect and engineering contractor for a data base engine test at Jackson Flats, Nev., to be used in testing the Nike nuclear engine.

Power and Generation Co., Decatur, Ala., will contract a control center for the new Saturn vehicle test facility at NASA's Marshall Space Flight Center at Huntsville, Ala. The SC-10400 control center for a two-story rectangular concrete building with basement is 450-ft (nominal) and supporting utility, various. The control center is scheduled for completion in late 1962 at cost \$195.

First order of 1 by Subscribers for the Navy is scheduled in an overall military purchase of 65 of the aircraft from North American Aviation, Inc.'s Los Angeles Division. Navy will get 35 modified versions of the original configuration, which will be designated T31F. The other 31 planes will go to USAF, boosting the total ordered by that service to 149.

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The first group of plants is fully made for life in a desert. This group includes shrubs and long-stemmed perennials in a bush but also cacti (columnar and pinnate) and many of the small, short-lived plants. Both kinds of plants are in the desert because of their ability to store water and to have a very low transpiration rate. The second group of plants is made for life in a desert but is not made for life in a desert. This group includes the shrubs and the long-stemmed perennials in a bush but also the cacti (columnar and pinnate) and many of the small, short-lived plants. Both kinds of plants are in the desert because of their ability to store water and to have a very low transpiration rate.

[illegible][illegible]

Tetradent feeds, specialized programs that preprogram, real time, to local system being established reporting procedures, and help expedite working with a single and greater manufacturers and great software companies give Tetradent Analysis a unique and efficient system to make available.



Sundstrand Aviation is spearheaded by a young, aggressive, creative, and experienced management team. Sundstrand experience includes applications for aircraft, marine, aerospace, and commercial equipment. A strong record of success in hydraulic, mechanical, and electrical components and development of systems capabilities makes possible computerized programs—from concept to completed project. Further information and design proposals on request.





HU-1B

HU-1D

In-flight comparison of old HU-1B (top) and HU-1D shows extended fuselage and redesigned engine cowling.

## Army Field-Testing HU-1D as Infantry Carrier



Army is field-testing the HU-1D helicopter as an infantry transporter to add to its role as a cargo aircraft and aerial ambulance. A comparison of the HU-1D and earlier HU-1B model shows that a longer fuselage, providing additional volume and fuel capacity, is the major configuration change. Fuel tanks were relocated and enlarged 14% to 120 gal. All drainage components fit the same as in the HU-1B, but the improvement is the 3,160-shp Lycoming T55-L-5 compared with the HU-1B's 960-shp T55-L-5. The HU-1D is readily identifiable by its extra side windows. Note blade antennas over the cockpit and also mounted on the rotor hub. Either man in hatch can be notified in the HU-1D rotor, which has a capacity of 225 cu ft, an increase of 57% over the HU-1B.



Earlier version of the HU-1D (above) can carry an litter and a medical attendant. The HU-1B cannot bear litter. Large one-way sliding door plus a quick-detach forward panel permits rapid loading. A complete 12-man infantry squad can be carried in the HU-1D (right) with the second seats and third seats behind the pilot in front of communications. Twenty of the helicopters can move an infantry company. Below, a squad of the 101st Airborne Division deploys during maneuvers at Fort Benning, N. C. The entire squad can leave the HU-1D in two minutes under optimum conditions. Helicopter engine cooling, shown in detail above and at right, has additional features and covers-covered rotor to provide improved engine cooling.





## ***Raytheon brings proven guidance and***

Three techniques are currently available to meet the challenge of Space Rendezvous Guidance: radar, infra-red and optics. Of these techniques, radar has been used for homing guidance systems to the greatest degree. Studies by Raytheon, whose radar experience spans three decades, have indicated that continuous wave radar possesses these desirable characteristics:

- No minimum or "blind" ranges
- Direct and accurate velocity readings
- Greater range for a given weight
- Ease of acquisition
- Simple FM Techniques for ranging
- Greater simplicity and reliability

## ***sensor capability to space rendezvous***

The experience gained from the inertial guidance system for the advanced Polaris, coupled with the proven success of the Hawk and Sparrow C W homing systems give Raytheon the most extensive proven capability applicable to the space rendezvous guidance problem.

In addition, Raytheon, one of the world's largest scientific-industrial organizations, has proven its ability to manage every phase of a complex system — from early study and design through development, production and field support of operational systems and equipment.

*Missile and Space Division, Bedford, Massachusetts*

**RAYTHEON COMPANY**

MISSILE AND SPACE DIVISION

**RAYTHEON**



**LOCKHEED C-140B**, military version of the JetStar, is painted in Military Air Transport Service markings. Air Force has ordered 16 C-140Bs, six of which will be operated by the 115th Air Transport Wing, Special Air Mission, MATS.

## Lockheed JetStar Special Report—Part 2

# Lockheed Faces \$80 Million JetStar Loss

By David H. Hollman

Minnetta, Ga.—Lockheed Aircraft Corp., which has spent \$160 million developing the JetStar, must sell at least 250 more of these utility transports to recoup its investment and probably will halt production if new orders fail to materialize early this year.

Despite initial Air Force interest in 160 JetStars—the figure translated in 1956 when industry was asked to design at its own expense a utility jet transport capable of carrying 5 to 10 passengers, Air Force orders now total only 16. With sales to all sources holding at 45 (AW Aug. 5, p. 67), Lockheed now faces current JetStar losses at about \$80 million. Of this, \$65 million has been covered by before-tax write-offs, and \$15 million in its administrative costs are reflected on Lockheed profit and loss statements. The balance, \$65 million, may be recovered from future sales.

To break even, the company must sell 192 JetStars. But the odds are heavily against a request for one aircraft support account, whether Government, Lockheed 1.25 or JetStar, in the Fiscal 1961 Air Force budget. Orders for corporate JetStars, however, have not kept pace with Lockheed forecasts.

At a current rollout rate of two aircraft per month, it takes Lockheed about nine months plus interest to build one JetStar. Of the 47 JetStars an order about 17 years to be delivered by Jan. 3. As a result, Lockheed is advised of enough business to keep its JetStar assembly line busy active through most of 1967.

But during that first quarter, the

company probably must decide whether production in 1963 can continue with out additional sales. It is doubtful whether that decision can be postponed, for Lockheed builds the JetStar as a jet liner and tries to gain enough orders during a specified year upon before allowing subsequent firm for production.

As for the JetStar, all of which will be operated by Military Air Transport Service, are of three types: for C-140As for flight checking, navigation aids, the C-140B mission support aircraft with convertible interiors and the VC-140B

primarily for carrying sailing diplomats and political personalities within our national U.S. All VC-140Bs will go to the 115th Air Transport Wing, Special Air Mission at Andrews AFB, Md.

JetStar was originally proposed as a transport transport powered by British-built Bristol Lycoming engines rated at 4,870 lb thrust on takeoff. But Air Force wanted better performance and did not balk with four on the wings powered by four General Electric engines to build it, under license, as the JT37A1. Commercial interest in the



**PREFABRICATED AND AIR CONDITIONED** are sections of JetStar (seen from above) slides forward to expose all electronic components for easy replacement or maintenance. Ten Jetties each covered and assembled through small hatch doors, lock into place.

transport JetStar also was limited to one or two capes.

Congressional records indicate that Air Force, during Fiscal 1959 through 1962, actually was authorized funds to purchase at least 30 to 35 C-140B jets. There is a breakdown of how much Air Force sought, how much Congress appropriated and how much was spent.

•**Fiscal 1959.** Air Force asked for \$21.5 million and Congress appropriated the whole amount. Of this, only \$5.5 million was obligated for the five C-140Bs.

•**Fiscal 1960.** Congress again appropriated the entire sum requested by Air Force: \$25.6 million, for 14 bench-suspension system trainers, but none of this money was spent.

•**Fiscal 1961.** Air Force budget did not include a request for C-140 funding. However, Air Force retained its threat to spend \$12 million for the six VC-140s in December, 1961.

•**Fiscal 1962.** Air Force requested \$19.1 million for six C-140s, but Congress voted only \$10 million, which was used to purchase the five C-140B mission support aircraft.

Going into Fiscal 1963, the former direct threat that Air Force had sought a total of \$64.3 million for 30 C-140B transports, Congress had allowed \$15.2 million and the service had spent \$18.5 million. According to the late Robert Cross (AW Aug. 13, 1962, p. 71) former Lockheed chairman, the continuing emphasis placed upon missiles and space projects by the Eisenhower Administration, and the overpricing of manned aircraft to make more money available, checked off not much more than C-140 procurement. Tactical aircraft sales, their support aircraft were rounded the highest last year.

In an effort to keep its JetStar program alive, Lockheed is concentrating on convincing Air Force that the plane is an ideal aircraft for short-range supply lines to U.S. units in Asia. Current components could go as far as 1,500 miles to supply lines and support by commercial means. Lockheed one trend. It also hopes that Air Force requirements in this area will lead to the purchase of about 400 aircraft.

Currently, the company is attempting to sell C-140 sales to the foreign governments of Lockheed F-104 fighters. West Germany, The Netherlands, Belgium, Italy, Canada and Japan have been licensed to build a total of 1,120 F-104s. Most of these will be equipped with systems similar to the North American Sea Hawk and Ringier Ruler (NASMR) that Lockheed is now in position, Britain in order, combat mapping and data range to target information in their pilots.

Lockheed has proposed the C-140,



**ROLL-OUT RATE** of JetStar assembly line at Lockheed-Geara Co. plant now is two aircraft per month. JetStar was planned to be produced four aircraft per month in early 1963, but military orders to date have not justified the increased output.



**CORPORATE JETSTAR'S** custom interior was added by Lockheed Aircraft Service of Oshkosh, Wis., which offers various modifications costing from \$45,000 to \$145,000 per aircraft. JetStar passengers may also directly with at least five other firms involved engineering done at Lockheed-Geara Co. Aircraft cost does not include custom interior.



# SUBSYSTEMS DEVELOPMENT FOR MANNED SPACE VEHICLES

ONBOARD POWER — H<sub>2</sub>-O<sub>2</sub> FUEL CELL POWER SYSTEM

## RELIABILITY & OPERATIONAL FLEXIBILITY

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at TAPCO  
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H<sub>2</sub>-O<sub>2</sub> Fuel Cell  
Power System



**TAPCO**

Thompson Ramo Wooldridge Inc.

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tion and decrease the need for pilots.  
As a result, pressure is generated to  
purchase aircraft such as the JetStar.

The JetStar's stated goal, its unique  
and its inherent economy requirement  
probably are partially responsible for  
its sales to date. Less expensive, the  
aircraft costs commercial or military pur-  
chasers \$1,360,575, an about one-fifth  
the cost of a Boeing 720B with turboprop  
engines. JetStar's maximum range of  
2,570 stat. mi., achieved with a payload  
of 1,840 lb. and Visual Flight Rules fuel  
reserves, is not open, unrestricted  
under all weather conditions. And, to  
achieve civil air regulations, the fully  
loaded aircraft requires a 6,435 ft. run-  
way to depart on maximum range mis-  
sion.

Lockheed emphasizes three points in  
selecting:

- JetStar's speed—One recently flew  
2,660 stat. mi. nonstop from Ontario,  
Calif., to Boston, Mass., in 4 hr. 30 min.  
at an average ground speed of 790 mph  
—the same time comparison for any re-  
quested refueling stops. Even if fuel is  
taken on en route, the JetStar can fly  
round-trip in less time than any  
conventional transport.

- JetStar's tailwind field length require-  
ment—distance to 5,900 ft., enabling  
it to operate from at least 1,000 ft. 5  
airports, on typical stage lengths of  
1,000 stat. mi. Flying such a mission,  
the transport would carry eight pas-  
sengers, a crew of three, full baggage  
and fuel reserves. Over 2,000 mi. distance,  
JetStar would need an airport with  
4,190 ft. of runway.

- JetStar's price includes full support  
services, such as pilot transition and  
both classroom and on-the-job training  
for mechanics employed by the pur-  
chaser, as well as a fully automated  
cylinder. Also, Lockheed has formed  
an international network of factory  
representatives to aid JetStar customers.

Plots testing experience as turbine  
powered usually may proceed on op-  
tional three-day course covering the  
airframe, engine, aerodynamics, high  
speed flight, jet engine, navigation,  
operation and use of radar and high alt-  
itude physiology. Normal two-week  
ground school follows the introduction  
to airframe, and includes 4 hr. on  
circular airframe, 5 hr. on electrical  
systems, 12 hr. on hydraulics, 4 hr. on  
fuel, 12 hr. on the T113A engine, 4  
hr. on pneumatics, 4 hr. on radar and  
radio, 6 hr. on instruments and the  
airframe, 16 hr. on performance, and  
4 hr. on JetStar operation.

Standard JetStar flight training re-  
quires 10 hr. of transition in the air-  
craft. This may be devoted to ac-  
cidents, as split between several. The  
average corporate pilot dispatched here-  
tofore, an Airbus, Transport 8 flying in  
the JetStar also about 10 hr. of transi-  
tion in the aircraft, Lockheed reports.



Way, may look at 1956 (recent history in the electronic  
industry). Rantec engineers, led by Lou K. Kirt, began working on electronic  
scanning antennas. Today, Kirt has brought the "flat plate" and wave antenna  
"into being", so to speak, where it is no longer theory alone but an integral com-  
ponent of the guidance packages of missiles and aircraft. Of course, Rantec has an  
advantage in marketing many of the research problems because Kirt could rely on  
the company's long experience in kinetic devices (another "old hat" department).  
The Rantec "flat plate" still may draw more with mechanical devices and provides  
for "electronic" device scanning. Beam shaping and changing cross-section scan  
angle. Monopulse operation can also be obtained with uniquely packaged hybrids.  
Global scans can be within several degrees of the reflecting surface reflecting input  
apertures due to minimum scaling space. Because there is no frontal feed inter-  
ference, there is no blocking of the aperture and very low side lobes result. There  
is no spill-over which means the efficiency is inherently greater than with reflector  
type antennas.

Now, let's face it: Can something really be as little as what you have been produced?



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of  
space  
achievement

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## NEW AEROSPACE PRODUCTS



### Attitude Environmental Chamber

New 12 cu. ft. chamber is designed to reproduce extreme environments of altitude, temperature and humidity simultaneously for evaluation of equipment performance.

Manufactured using the Model 2040 chamber can simulate altitudes down to sea level to 100,000 ft., temperatures from -400 to +600 and 10/95% relative humidity over a load temperature range. The 2 x 3 x 3 ft. chamber is fitted with ports for transmitting electrical, pneumatic, or hydraulic signals to test equipment. **Baratron Co., 7549 San Fernando Rd., Burbank, Calif.**



### Holding Entry Director

Device is designed to enable a pilot to visualize quickly and accurately his position relative to the holding pattern and the fix. The entry procedure is illustrated on the scale.

Manufacturer claims that two set-ups of the director will enable the pilot to determine his position in relation to the fix. The entry procedure, his selected or national course and heading headings, which are listed on the respective scales. Heavy-duty plastic display is available in a 5 x 6 in. case.

**Entco, Box 44-411, Miami International Airport, Miami 30, Fla.**

## SPACE TECHNOLOGY

### Manned Space Flight Simulated on Ground

By Edwin J. Bellon

Dallas Tex.—Complex manned space systems are being developed here with a high degree of realism, including some of the physical stresses involved, using a new simulator designed and built by Chance Vought Corp.'s Astronautics Division.

Capable of simulating virtually any type of manned space vehicle from earth orbital to lunar and interplanetary configurations, the system is capable of handling all the varied phases of such missions including launch, orbit, rendezvous and course guidance, reentry, landing approach and landing. It is also adaptable for studies involving conventional aircraft, vehicles that would operate in the atmosphere and in space, and vertical takeoff and landing aircraft.

Basically, the simulator system comprises a gondola containing a cockpit with completely mechanical pilot displays and controls. Enclosed in a moving base providing freedom about roll, yaw and pitch axes and a pitching base capable of rotating the gondola through 150 deg. sideways and end-over-end. It also has an external projection of instrument panel layout and star fields and an on-board digital computer capable for providing specific vehicle characteristics, display parameters and control status configurations.

System cost, including the existing computer facilities used in its operation is estimated at \$2 million.

#### Spacecraft Studies

Simulator will provide test drivers of Long-Term Vought with the capability for making detailed and controlled studies of spacecraft and their various. It also will provide a facility for testing and understanding of flight crew.

The simulator is expected to be a major research tool for the company's Life Sciences Section in conducting physiological studies on subjects in the simulator, and for determining the effects space vehicle stresses will have on man and his ability to perform necessary manned space mission tasks.

Providing an insight into some of the work the company is planning with its new equipment, Simulator Group Supervisor William B. Lakso told Aviation Week that initial studies made in the course of checking out the equipment are scheduled.

• Close simulation of a two-stage Saturn mission with an Apollo-type three-man cockpit, entering the load profile from



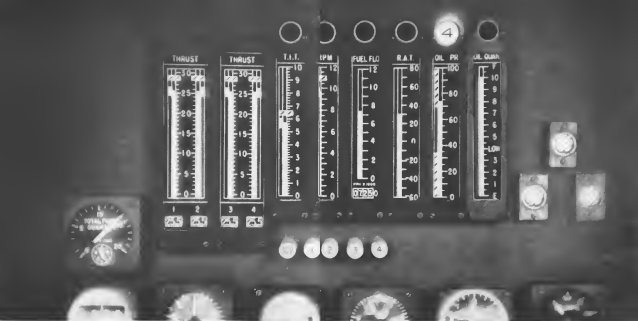
cockpit of Chance Vought manned spacecraft simulator is equipped with controls and pilot displays. The cockpit gondola is mounted on a moving base providing freedom about roll, yaw and pitch axes. Pilot has three main windows in front and an indicator to view the field and horizon line which are projected on inner wall of dome surrounding the cockpit installation. Perspective is controlled about pilot's head. Pilot has a viewing full pressure suit.



OVER-ALL VIEW of Chance Vought simulator shows entry mission's control panel in foreground, with the manned flight simulator gondola in background, inside floor plate shows closed-circuit television across in control panel enables monitor to watch pilot during simulated flight. Television screen is mounted on rear of cockpit gondola. System is designed to simulate all phases of space in atmosphere flight.







## TROUBLE IN ENGINE #4

Spot it first with the new Bendix propulsion data system. This advanced digital computer system offers a new high-speed, 100% vertical scale display that simplifies engine management and saves panel space. The system automatically monitors parameters of all engines 2 1/2 times each second... continuously displays the worst performance of each parameter... signals when to take corrective action. Vertical scale instru-

mentation features electro-luminescent lighting and provides a running visual comparison of actual performance with optimum and "never exceed" values. Each engine can be monitored separately when desired.

The system handles engine management for an entire flight profile. It relieves crews of time-consuming manipulations required by engine management charts. The results

are a considerable increase in efficiency of engine performance, increased fuel economy, and longer engine life.

This new Bendix propulsion data system is adaptable to any number of engine functions and to any type engine... turbo-prop, turbojet, VTOL, STOL, multi-engine and single-engine. On a typical four-engine turbo-prop aircraft requiring 36 indicators to present 36 conditions of engine

performance, the new system presents 80 conditions of engine performance on 30 indicators in 1/6 inch space. Developed by Bendix in cooperation with the Air Force's Flight Vehicle Section, Aeronautical Systems Division, the system offers a new concept in aircraft engine management efficiency. Write to us in Teterboro, New Jersey, for a copy of our booklet, "Propulsion Data System."

Eclipse-Pioneer Division



WHERE IDEAS  
UNLOCK  
THE FUTURE

# VIBRA-

portion of the pilot's seat, producing up to approximately 5G's for short durations in pitch and yaw. It also produces the vibrations associated with entering a maneuver. Since the simulator is limited in shake, the resulting acceleration can be obtained only very briefly. A wireless network in the computer system integrates gondola motions and shake remaining to create the acceleration before the gondola hits the stops. However, destination forces are initiated before the human feeling threshold and the gondola returned to the neutral position. Then the pilot feels only the acceleration forces associated with the start of the maneuver. The used precautions on the panel and through the ports continue to provide him with the exact sensation of the maneuver being through, so that psychologically, at least, he feels going through with the proper control to handle the vehicle and accomplish the mission.

The entire vibration operation is directed from a control station located in a separate room. This facility has a control console, plotter, television screen, oscilloscope, the pilot's face, shoulder and torso angle configurations indicator allowing start of a flight or any desired phase of the mission, fuel/gage readout, engine, hydraulic, oxygen circuit to be added to the pilot's seat to provide realistic experience, the controls which can be used to introduce simulated failures during a mission, and emergency hydraulic pump system that will switch to terminate the next test operation.

A safety station also is located in the room with the gondola so that a mission can be terminated immediately in case of an malfunction.

The entire system is located in the room with the gondola so that a mission can be terminated immediately in case of an malfunction.



**CEC**

Transducer Division

**CONSOLIDATED ELECTRODYNAMICS**  
PASADENA, CALIFORNIA - A SUBSIDIARY OF BELL & HOWELL

# TION?

## In trucks, trailers, flatcars? CEC Accelerometer (4-202) will tell.

This little atom gives accelerations (1 cubic inch, 3 ounces) with low cost and elegant appearance steel eyes (steel) look as it is, it happens to be better than all comparable accelerometers. Its lower cost wins response, and its design change with temperature, highest accuracy frequency, operable temperature range from -70°F to 300°F. And it's just as durable as the one over there on the left. Need more? Call your nearest CEC office or write for Bulletin CEC 4302-X12.



**CEC**

Transducer Division

**CONSOLIDATED ELECTRODYNAMICS**  
PASADENA, CALIFORNIA - A SUBSIDIARY OF BELL & HOWELL

## USAF Contracts

As Tech. Office of Scientific Research recently awarded 15 grants and contracts totaling approximately \$7.5 million to colleges, universities, non-profit research institutions and individual investigators. Grants were in the following:

**University of California, Berkeley** (Contract DA-19-617-AMC-001) for research in the area of aircraft.

**University of California, Berkeley** (Contract DA-19-617-AMC-001) for research in the area of aircraft.

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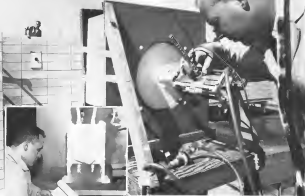
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**University of California, Berkeley** (Contract DA-19-617-AMC-001) for research in the area of aircraft.

## WHERE IDEAS UNLOCK THE FUTURE



Relative characteristics of ADVENT systems being measured on the Bendix systems range of transmitters. Top—ADVENT 1000; middle—ADVENT 1000; bottom—ADVENT 1000. Left—Drawing and after these preliminary tests, when accepted, the entire search and orbital conditions in which they will be applied. The ADVENT systems performed well.

**THOROUGHNESS** in developing and testing components is the key to Bendix reliable space communications equipment. Opportunities are open to join our staff on advanced programs such as the ADVENT Satellite Communications System, under direction of the U.S. Army Advent Management Agency. Engineers, experienced in satellite communications, structures, cooling, launch site systems, A-J techniques, antennas, GSE, circuit and microwave development, and data handling and storage, are invited to send résumés to us at Ann Arbor, Michigan. An equal opportunity employer.

**Bendix Systems Division**



determination of optical constants from an  
Bios in its own.  
University of Michigan Research Insti-  
tute, Ann Arbor, Mich.—48106 for ad-  
vanced research on optical constants from  
surface to atomic structure.  
University of Southern California, Uni-  
versity Park, Los Angeles, Calif.—90089 for  
research in plasma and magnetohydro-  
dynamics.

State University of New York City, City  
College, New York 10031 for the study of  
and synthesis of chemical compounds.  
Physics Department, University of Illinois,  
Urbana, Ill.—61801 for the study of the  
structure of liquid crystals.

University of New York, Albany, New  
York 12214 for the study of the  
structure of liquid crystals.

University of California, Berkeley, Cal-  
if.—94720 for the study of the  
structure of liquid crystals and the  
structure of liquid crystals.

In addition to previously mentioned  
USAF grants the following research  
was awarded to educational institutions:

Naval Research Institute, 422 York St.,  
Washington, D.C.—20340 for the  
study of the structure of liquid crystals.

Naval Research Institute, 422 York St.,  
Washington, D.C.—20340 for the  
study of the structure of liquid crystals.

Naval Research Institute, 422 York St.,  
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Naval Research Institute, 422 York St.,  
Washington, D.C.—20340 for the  
study of the structure of liquid crystals.

## A MIGHTY STABLE POWER SUPPLY



The STP-500 is a heavy duty, all-transistorized 4 x power source. It features exceptional line and load regulation of better than 30mv. The unit employs low load linearity and the complete absence of line linearity make this the only ideal for power semiconductor that are sensitive to voltage spikes.

The unit has an electronic short circuit protection and automatic failure protection. Additional features include:

- Thermal protective circuit
- Load or remote sensing
- Transistor mounting circuit

The STP-500 is ideal for control support equipment and high current applications. It provides from 25 to 30 volts d.c. power at 100 amperes and to 125 amperes short term. It will deliver full power even with up to 20% of the regulator transistors non operating. The unit is constructed primarily of MIL-Formal and aluminum MIL-7221 semiconductors and ruggedized motors. It is certified to meet MIL-7221.

The supply is designed to fit standard racks.

19" x 21" x 21"

PRICE—\$3,500 F.O.B. Santa Monica, California

Business letter manufacturers a wide line of both d.c. and a.c. laboratory power supplies as well as modular power supplies for rack mounting. For detailed information, write for

**BEHLMAN-INVAR ELECTRONICS CORP.**

107 ELDERFIELD BOULEVARD—SANTA MONICA, CALIFORNIA

Business letter manufacturers a wide line of both d.c. and a.c. laboratory power supplies as well as modular power supplies for rack mounting. For detailed information, write for

Business letter manufacturers a wide line of both d.c. and a.c. laboratory power supplies as well as modular power supplies for rack mounting. For detailed information, write for

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*The Lincoln Laboratory program for ballistic missile range measurements and penetration research includes:*

## EXPERIMENTAL RESEARCH

Measurements and analysis of ICBM flight phenomena for development and for decay stage purposes, including optical, aerodynamic and RF effects.

## SYSTEM ANALYSIS

Studies to apply research findings to advance the technology of ICBM and ACBM systems.

## INSTRUMENTATION ENGINEERING

Designing radar, optical and telemetry equipment with which to measure ICBM flight effects under actual strap conditions.

## RADAR SYSTEMS RESEARCH

Extending the theory and capabilities of radar techniques to problems of discrimination, countermeasures and performance in a dense target environment.

## HYPERSONIC AERODYNAMICS

Study of the flow fields around antenna bores for various body designs and flight conditions. Excellent computer facilities available.

## RADAR PHYSICS

Theoretical and experimental studies in radar back scattering, interaction of RF radiation with plasmas.

• *A more complete description of the Laboratory's work will be sent to you upon request.*

All qualified applicants will receive consideration for employment without regard to race, sex, color or national origin.



Research and Development  
**LINCOLN LABORATORY**  
Massachusetts Institute of Technology  
BOX 25  
LEXINGTON 73, MASSACHUSETTS

not be in mission, mission  
United States Air Force, Wright-Patterson  
AFB—2-1111 for contract and study of  
various types of missile systems  
aerospace, electronics, etc. Letter: 30-  
3211 for the establishment of a study of missile  
in the research of weapons.

At Force has recently awarded the  
following contracts:  
North American Aviation, Inc., Los  
Angeles, Calif. will perform the production  
of 12 T-11A aircraft, 12 T-11B aircraft and  
related aircraft.

Palmer Corp., Palo Alto, Calif.—will  
perform the production of 12 T-11A aircraft  
and related aircraft.

Lockheed Aircraft Corp., Burbank, Calif.—  
will perform the production of 12 T-11A  
aircraft and related aircraft.

Boeing Aircraft Corp., Everett, Wash.—  
will perform the production of 12 T-11A  
aircraft and related aircraft.

McDonnell Douglas Aircraft Corp., St. Louis,  
Mo.—will perform the production of 12 T-11A  
aircraft and related aircraft.

General Dynamics Corp., Fort Worth, Tex.—  
will perform the production of 12 T-11A  
aircraft and related aircraft.

Northrop Aircraft Corp., Inglewood, Calif.—  
will perform the production of 12 T-11A  
aircraft and related aircraft.

Grumman Aircraft Corp., Bethpage, N.Y.—  
will perform the production of 12 T-11A  
aircraft and related aircraft.

Republic Aircraft Corp., Farmingdale, N.Y.—  
will perform the production of 12 T-11A  
aircraft and related aircraft.

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aircraft and related aircraft.

## New Offerings

Carbon Metal Products, Inc., Brook-  
lyn, N.Y., engaged in the manufacture  
of metal components and electronic  
hardware to precision tolerances. Offering  
is 100,000 common shares at \$4 per  
share. Proceeds will be used to repay  
existing loans, to finance the purchase  
of new production equipment, to con-  
solidate manufacturing facilities, for re-  
search and development toward the  
establishment of a proprietary line of  
quality "ready-to-install vacuum  
system" cabinets and housings.

Continental Industrial Electronics  
Corp., Los Angeles, Calif., engaged in  
the development, engineering, and  
manufacture of industrial and govern-  
ment special purpose reliable air tubes  
and the manufacture of connected  
vacuum pressure tubes. The company  
was organized in October 1961, for  
the purpose of engineering the assets  
and increasing the liabilities of Continental  
Electronics Corp. of California. Offer-  
ing is 300,000 common shares at \$2.50  
per share. Proceeds will be used to pay  
in cash existing bank loans, to repay  
the balance of a loan to Charles Thiel,  
an officer, to purchase additional equip-  
ment to enable the company to pro-  
duce vacuum components for its custom-  
er tubes and to obtain qualifications  
for certain radiation type tubes, to in-  
crease productive capacity, for adver-  
tising to the industry, to finance addi-  
tional research work.

Mission Research & Development  
Corp., Wilmette, Mass. (organized in  
May, 1961), engaged in research to  
its effort to develop new materials, new  
methods and techniques for testing  
tubular and to develop and design  
products and designs resulting from re-  
search efforts initiated by the company  
to meet changing engineering speci-  
fications of the electronic, vacuum and  
space industries. Offering is 100,000  
common shares by the company at \$3  
per share, and 150,000 outstanding  
shares by the holders (after completion  
of the company's sale, at prices and in  
amounts of those prevailing in the over-  
all market situation). Company's pro-  
ceeds will be used in the development  
of projects including a microbeam fu-  
sion, an electron beam evaporation  
device, a high temperature X-ray  
camera, a portable power supply unit,  
a portable metal powder spray unit,  
plasma-surface powder combustors and  
resonance compounds for tubular  
stress.

Uticon Electronics Corp., Grand  
Rapids, Mich., engaged in the manu-  
facture of high precision instrumental  
components for aircraft and space  
guidance systems. Offering is 250,000



# PURTAN RIDES the BOEING 727

... FOR GREATER PASSENGER SAFETY, Puritan's automatic  
valve assembly for passenger outlet stations has been specified  
for the oxygen breathing systems in the Boeing 727. It is a com-  
pact, integrated unit with all the valves and the latch combined,  
and enables passengers to be supplied with emergency oxygen  
if needed.

Your inquiry on any problem concerning high altitude breathing  
systems and equipment would be welcome.



Puritan's automatic valve assembly is mounted  
in the Passenger Service Unit above the  
passenger, and in the overhead.



AIRSPACE DIVISION  
**Puritan EQUIPMENT, INC.**  
1703 McFee Street • Kansas City 8, Mo.

A subsidiary of PURITAN COMPRESSED GAS CORPORATION

BREATHING LIFE INTO AIR AND SPACE TRAVEL



## THEY RELY ON RADIATION for proven PCM telemetry in Titan

The recent launching of an Air Force Titan led a missile borne PCM telemetry system into space for the first time. Designed and built by Radiation Incorporated, the advanced system also marks another, and more important, first in the telemetry field. Its capability of processing both digital and analog data in a single compact unit weighing less than 25 lbs.

With the spaceborne system, Radiation provides an Inert Simulator for pre-launch checks and a Control Check-out Rack for ground synchronization and decoding. Capability of further combining the spaceborne package with existing Radiation circuitry for low-level signal conditioning makes possible the universal system approach.

Radiation pioneered PCM techniques, and is recognized for many of the significant advances in the state of the art. This fast-growing company offers attractive career opportunities in a broad spectrum of scientific and engineering specialties. All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin. For details on Radiation—and an Inert PCM development—write Dept. AW 12, Radiation Incorporated, Melbourne, Florida.



**RADIATION**  
INCORPORATED

common shares at \$2.30 per share. Proceeds will be used for the purchase of additional testing and production equipment, to reduce current liabilities, to hire additional personnel and to increase inventories and receivables.

**Adams Industries, Inc.**, Westbury, N. Y., engaged in the design and manufacture of pressure switches, pneumatic and fluid valves and various control mechanisms for aircraft, missiles and submarines to provide system protection, proper operational sequence and desired pressure, to meet flow needs, merge elevated gases, etc. Offering in 50,000 common shares at \$4 per share, 25,000 shares for public sale by the company, and 25,000 over-the-counter shares by Edward Berlin, president and sole stockholder. Company's proceeds will be used to purchase capital equipment and to expand its sales representative base.

**Almos Electronics Corp.**, New York, N. Y., engaged primarily in research, design, development and production of advanced electronic systems and supporting equipment for the armed forces. Offering in 20,000 outstanding capital shares. In September, 1961, the company issued 70,000 capital shares to William L. and Bala V. Hopkins in exchange for the outstanding shares of Hopkins Engineering Co., a wholly owned subsidiary. The company proposes to sell the 20,000 shares Hopkins Engineering manufactures high quality capacitors for industrial and military applications, and films for radio interference reduction.

**SMS Instruments, Inc.**, Jamaica, N. Y., engaged in the repair, maintenance, testing and overhaul of instruments and accessories for aviation and commercial aircraft. Offering in 100,000 common shares at \$1.25 per share. Proceeds will be used to purchase additional equipment and special parts to increase jet aircraft, to repair the balance due on a bank loan, to improve the accuracy of its instruments and to fulfill other obligations.

**Transdata, Inc.**, El Cajon, Calif., incorporated in September, 1960, for the purpose of conducting research and development in the data and image processing and transmission field. At present the company is working on computer interface equipment, display and printing devices, basic system components for character recognition, image recording and system controls, and standard electronics products. Offering in 100,000 common shares at \$5 per share. Of the proceeds \$175,000 will be applied to the acquisition of short term bank financing.



## Taber Transducers are Martin choice to pick up engine data during Titan flights

Operating as components of a Martin Co. Inertization System, Taber Telemetry Beamed Stress Gauge Pressure Transducers gather important engine performance data during flights of the Air Force's Titan I BGM. The 6-750 psig Taber Transducer, shown above, checks the pressure of engine number one thrust chamber. Three other Taber Transducers are used to measure (1) engine number one start gas pressure, (2) sustainer engine low separator manifold pressure, and (3) sustainer engine gas generator pressure. Martin chose these instruments "because of their ability to continuously give accurate data even when subjected to extreme temperatures."

Taber performance advantages are many: high frequency response, infinite resolution, hysteresis less than 0.28% full scale, and low sensitivity to temperature effects, shock or vibration. Models are produced for a wide variety of test, ground support or airborne applications, with pressure ranges from 0-80 to 0-10,000 psi.

Detailed and illustrated literature on Taber Transducers may be obtained by simply mailing this coupon attached to your letterhead.

TO: TABER INSTRUMENT CORPORATION  
ATTENTION: ELECTRONICS DIVISION SECTION 40  
200 Bundy Street, North Haven, Conn. 06457

First attach attention to Taber Telemetry and Telemetry Beamed Stress Gauge (please forward)

NAME	_____
ADDRESS	_____
CITY	_____
STATE	_____
ZIP	_____

## Kodak knows the eye-to-brain business

The presentation of any kind of image—photographic, electronic, or anything better that may occur to you—to the human brain for a judgment of what it shows and whether it matters is tricky business. Electronics is helpful in this type of work, but not sufficient. Here we enter the realm of psychology and psychophysics, sciences in which Kodak's foundations, for safety's sake, have to go down to bedrock.

Which brings us straight to the reason why Kodak is prepared to take up the pioneering jobs in this category. They need doing. Presentations equipment needs to be updated to the potentialities of present information-gathering systems.

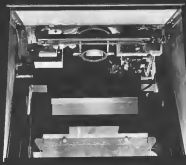
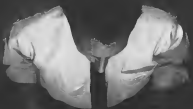
A goodly crew of Kodak scientists have devoted a fair number of Kodak man-decades to study of the capabilities and limitations of hu-

man vision. These men are not employed to put out fires encountered in the course of conducting a film and camera business, though it is true that film and cameras guide their salaries. On the scientific foundations they have been laying down, their engineering colleagues can raise the state of the art of image presentation to new heights.

Visual engineering is often handicapped in that its helpful contributions look dull. (The object gets attention, rarely the art of seeing.) Look at the picture on the opposite page. You are looking inside an experimental Kodak viewing device, just behind a translucent screen on which an image is projected from behind. No matter how sharp the original picture and no matter how good the projection lens, the simple machinery behind

the screen can always yield a noticeable improvement in the sharpness. It does this by introducing time as an integrating factor to cancel out optical noise due to misaperture local radiance distributions of intensity that are inherent in efficient transmitting diaphragms.

It also makes the screen more pleasant to stare at. Staring at a screen for long hours of tedium constitutes imposed psychological conditions different from those an engineer encounters when he takes a look and decides everything is good and sharp and that's that. Fluctuation along the conduct-anywhere axis strongly affects systems that unlike eyes act as a gateway to brains. We can help because the science and engineering of visual happiness are and have long been very sober business for us.



PHOTOGRAPHY

OPTICS

ELECTRONICS

MECHANISMS

INFRARED

For a discussion of new approaches in image presentation or in other applications of the technologies in which we work, or for a booklet entitled "Kodak's face in being" that defines them, communicate with Advanced Planning Department,





KNOW YOUR ALLOY STEELS . . .

This is one of a series of advertisements dealing with the various aspects of life. They are all of the same size and are all of the same color. They are all of the same size and are all of the same color.

## Cold-Finishing of Alloy Steels: The Cold-Drawing of Bars

Cold-finishing of alloy bars may be divided into two general categories: (1) cold-drawing, where the bars are pulled through a die with no surface removal; and (2) turning and grinding, and grinding and polishing both of which remove the surface. Only the cold-drawing procedure is discussed here.

Cold-drawing is the process of pulling a pickled-and-fired bar through a die for the purpose of producing a lighter, smooth surface finish, and close tolerances. The alloy bars are prepared for cold-drawing by pickling in a hot solution of dilute sulfuric acid for removal of scale. This is followed by a water rinse, and immersion in a hot lime-water bath to neutralize the effects of the acid, as well as to and in carrying special liquid lubricants onto the die.

Alloy bars may be cold-chamber in any of four conditions: as-cast (normalized, as-cast [ferritic or spheroidized]), re-tempered and tempered. These conditions are determined by the grade of alloy steel, the hardness, and the mechanical properties desired for a given end use.

In cold-drawing, the alloy bar is machine-powered to reduce the size at one end so it will pass easily into the die opening. Otherwise, the bar is pulled or extruded into the die by an auxiliary device. A die-holder, which can be made to contain from one to four dies, is mounted in an appropriate head assembled across a "draw bench," so that from one to four bars can be drawn at the same time. The draw bench has a bed which accommodates a stretched bar with loose ends

grip the pointed ends of the beams as they emerge from the dies. The buggie has a hook on one end which engages an end of chain, thereby pulling the bars entirely through the dies.

After cold-drawing, each bar is fed automatically into a straightening machine, and is sheared to "crack-free" lengths on appropriate machines. Saw are used when the cross-sections of the bars are too large to be rolled or sheared, or when square ends are required.

Smaller sizes in the form of rails are drawn as "bull-blocks," or "wye-blocks," depending on size, followed by straight-corn and surplus on special machines.

Specifications for chemical composition, grain size, hardenability, and the like of cold-drawn alloy steels have been given less study by British iron metallurgists.

If you would like suggestions on cold-chamber products, or any other problem concerning alloy steels, our metallurgists will be glad to give you all possible help, without cost or obligation on your part.

In addition to manufacturing the entire range of AISI alloy steels, Bethlehem produces special analysis steels and the full range of hot-rolled carbon grades.

This series of alloy steel advertisements is now available as a compact booklet, "Quick Facts about Alloy Steels." If you would like a free copy, please address your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.



For information  
— Economy  
— Business

\* AVIATION WEEK  
JULY 20-26, 1997

**OPTICAL MASER** ranging and telescope radars, to go into operation next year at Chud-cot, N.M., as the White Sands Missile Range, will track USAF satellites like the Air Force Systems Command's Discoverer shows, being demonstrated in an Aviation Week staff's concept. Light beams generated by the radars will range off precisely selective targets over 130 mi. away.

menting of the American Physical Society. This development appeared as a serious, logical next step in the program of research in the field of open magnetic devices. In conventional magnets the flux is highly concentrated along the axis; this high concentration is precisely what the negative magnetic device opened at Imperial College in England could achieve.

will be developed under sponsorship of the U.S. Department of Energy (DOE) and the Army Research Office-Durham (ARO). As a system development tool, one of the first experiments to be devised consisted of optical laser R&D and is expected to go into operation at a high-altitude observation site based near Fort Huachuca, NM, on the White Sands Missile Range

The system will use an optical image-reading transmitter mounted on a 48-in. satellite trucking telescope. The

### Random Sampling

A median sampling of all the new government-funded optical image processing industries that exist of these in the scope is first sign stars can be picked up by the telescope then fed to a sensor is high-quality image enhanced.

Each device pilot a few intense studies, rather than intense development efforts. This suggests that the million-dollar system contracts are still remote. Many of the contracts are just awards of \$100,000 figure size or which are agencies' initial, second, or even third orders. The

Advanced Astronautical in Monterey, Calif., has a 51 million ASD contract to develop the 45th telescope, a pair of 15-in. auxiliary visual aquaplane tracking telescopes to be mounted with the main instrument and a large pressure tracking camera.

• **Starlike tracking**—Combination optical raster ranging from optical television tracking system, capable of tracking a target in any direction.

Soldiers are expected to include American Atmospheres, Hughes, Lorton Industries, Optics Technology, Radio Corp. of America, Raytheon and Teledyne.

could be made unsmoothly high also

- broad range, ergonomic, tracking – high angular resolution obtainable with optical mouse ranging system makes the device well-suited for this class of application

- Navigation

• **Sensitometer guidance**—Principle here is the same as in space, except that acceptable ranges would be more restricted. A system of this type is being considered as a substitute procedure for the use of the Shallick test in the future in between the use of First (AW Jan 3 p 17) Shallicks until because on the micro, light beam directed at a target by the optical raster in this optical raster of the micro-raster indicates ending guidance system. Value of this system would be in the extremely high accuracy made possible in the micro-raster light beam and the difficulty in use would be the need for a more accurate system. The system would be a more accurate system than the Shallick test, but it is not clear if this system probably will be useful before the summer.

• **Harrisfield** **singing**—Several Army engineers, the Signal Corps and Frontier Scout using them are interested in the high singing arrangements and installation which an optical sensor imaging system (efficient optical sensor) could provide against tanks, weapons and personnel carriers, artillery, etc. when flown in line-of-sight locations in helicopters or high-altitude aircraft.

[illegible]

Among recent developments in optical materials are the appearance of a non-resonant wave, (cw) solid-state infrared laser and the operation of an optical mixer using an organic molecule in an organic glass. The cw mixer is a significant step in the accelerated pace of developments in the field was reported here recently by scientists from Bell Telephone Laboratories at a meeting

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Excerpt taken from *My Mother's House* by Frances Fitzgerald

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# NEW SIMULATORS



**ATTACK SUBMARINE TRAINER** provides a "clear" of ocean miles wide and fathoms deep, with multiple targets, including aircraft—indoor. Environmentally realistic Attack Centers of three classes of atomic subs are used to train crews. The subscapes seen through the periscopes

are in full color and targets change bearing, size and aspect as real-time battles progress in this digital computer oriented device. The computer program generates as many as nine different scenarios and also determines hits or misses as if in actual combat. \*



**Replica duplicates operational missile in exact detail**

Little John warheads are manufactured by Honeywell's Ordnance Division, Littleton, Honeywell developed

the Little John Trainer which is a full-scale replica having the exact weight, dimensions, and balance of the operational missile. It is used with operational launching equipment and GSE. All phases of handling, checkout and launch are simulated realistically—even to smoke from motor ignition and burning. \*

**Shipboard device cuts cost of training crews**

**Mk 6 Launcher and Missile Simulator** exactly simulates launcher and missile functional aspects, without utilizing operational equipment. Bypassing of the operational launcher reduces wear and maintenance, keeping it constantly available for tactical use and permits shipboard weapon system training without the expense of firing live missiles. The simulator also provides capability for malfunction insertion for trouble shooting exercises. The Mk 6 was developed under the direction of the Bureau of Naval Weapons.

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\*Developed for under development under the direction of the Naval Training Research Center, Pearl Harbor, New York.

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## BUSINESS FLYING



**HUGHES 269A HELICOPTER** weighs 4,800 lb. with full fuel (75 gal.). Maximum permissible gross weight is 5,500 lb., providing for a payload of 400 lb. Minimum hover ceiling of the aircraft to ground effect is 5,500 ft.

### Aviation Week Pilot Report:

## Hughes 269A Aimed at Untapped Market

By William S. Reed

Culver City, Calif.—Hughes 269A two-place helicopter, a stable, responsive aircraft designed for ease of operation and maintenance, produced by Hughes Tool Co., is aimed at tapping a market not previously being serviced by any business aircraft or helicopter.

Flown by the Aviation Week pilot, Hughes 269A, another N 8701F proved to be considerably easier to operate than larger, more complex helicopters. Principal criticism to elicit extensive aviation background should have little difficulty obtaining a helicopter rating in the 1980s in the projected 25 hr. flight time.

Along with a production site which Hughes Tool Co., Aircraft Division expects to reach two per day within the next year, the company is producing

an extensive training program for pilots and maintenance personnel. The more than 100 employees on training is provided in a marketing philosophy which hopes to extend the advantages of the small helicopter to businesses not able to employ a fixed-wing airplane. Pricing of \$12,500 and operating costs as low as 13 cents/hr. are far better than Hughes believes they can sell 100 269As per year.

An example of the type of business Hughes hopes to open up for helicopters takes a few days to fly for the 269A granted to the Shepherd, Mulcahey Co. in Los Angeles. Long established in the sales and service of heavy construction machinery, the Shepherd Co. has been using fixed-wing aircraft for transportation. Although entering into the field of helicopters after some somewhat modest success

heavy construction equipment, it initially makes economic sense, Hughes contends. Operation of construction machinery made an ideal market for the 269A because these operations often are in a remote area and landing area for fixed-wing aircraft seldom are available.

Operation of this sort of machinery for the light helicopter, according to Hughes, and they hope that through dealer like Shepherd, the advantages of the helicopter can be demonstrated to a large segment of potential customers who might never get over an airport. Not all developments are geared to business markets to involve, however, and many developments are going to fixed-base operators, many of them fixed-base dealers.

Training will be conducted locally by the dealer because Hughes believes maintenance and delivery pilot maintenance



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crusting speed is 55 mph. Absolute sailing is 11,500 ft. Flowing sailing in ground effect is 6,500 ft., 4,800 ft. out of ground effect.

The 2BFA is designed for high volume production which Flagler Vane Products Sales Al Boyer says will reach two per day within one year. Some of the design features which permit out-of-the-box assembly:

- **Simplified blade construction**—A one-piece aluminum section forms the leading edge, mid span spar of the blade, vane and which is stamped a dual skin. This is bonded to the spar and is a monocoque wedge leading edge. Assembly is put into a jig in a curing oven where the proper aerodynamic twist is automatically set into the blade. Through this method replacement blades can be sold for \$150. Blade life presently is 1,400 hr and may be increased. Flagler engineers add: Tail rotor blades feature a steel spar bonded to glass fiber skin. Service life of torque rotor blades is 1,000 hr and replacements cost \$70.00 each.

- **Tail rotor torque tube**—Constructed of a single piece lightweight tube—about 7 in.—the torque tube is splined at either end and has no midpoint bearing or sensor. When the tail rotor, bearing is a single Teflon vane bearing at midpoint. Contact between tube and bearing is intermittent and designed only to eliminate whip.

- **Extensive use of plastics**—Non-structural parts such as underbody fairing, exhaust duct, nose, cone, cooling ducts, etc. are constructed of molded plastic. Lightness and corrosion resistance coupled with required strength are among the advantages, Flagler notes.

**Simplified Flying**

Using the 2BFA is simpler and requires less technique than flying other fully articulated rotor helicopters. It will do so because the inherent, positive stability of fixed-wing aircraft but it does require less attention to flight than the larger rotorcraft flown by the Army. Work pilot. Like other non-winged aircraft, it must be flown by a vehicle and the inexperienced helicopter pilot must make constant reference to the altimeter to detect a climb or dive.

A trim system allows the pilot of an aircraft control pressure during steady-state flight and a variable friction station allows individual adjustment from seat acts to have control system forces.

Once trimmed in steady-state, flight, the helicopter will be hands-off unless disturbed by wind air.

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We point to you a reply within one week.



**PRODUCTION LINE** at Hughes Tool Co. Aircraft Division turned out first helicopter (August, 1961, 25 months after first deliveries at end of 1958) stood at 15. In addition to the 15 on hand in the foreground, eight others can be seen covering show line in center of floor. First is located at Hughes Airport, Culver City, Calif.

main rotor mechanism, accurate climb rate and forward pressure gauges. Auto-rotor speed gauges are provided for engine oil pressure, engine oil temperature, fuel pressure, fuel quantity and generator output. Red warning lights are provided for transmission oil pressure (low oil or over temperature). These automatic type warning lights have the same designation as in aircraft that do not have auto-rotors, but they do not show trends and they cannot be seen if the lenses on the bulbs are in bright daylight.

Starting the engine is accomplished with an electric starter. After smooth engine operation is attained at 1,500 rpm, the clutch lever is moved forward tightening tension on the eight belts and engaging the rotor. When fully engaged, engine rpm will be 1,500 rpm. Throttle is not advanced as rotor is engaged. After operating temperatures are within limits, inspection is checked at 1,800 rpm.

Takeoff is accomplished after the engine reaches 2,700 rpm at which time rotor speed comes up to 470 rpm. Raising the collective while holding a good amount of left pedal results in a vertical takeoff after which the machine can be maneuvered into forward flight. Best climb speed up to 500 ft altitude is 60-70 mph, after which climb speed is reduced to 45 mph. Power is adjusted by using the throttle to control rotor field pressure and collective pitch to control rpm. Rate of climb at sea level,

standard day, is 1,450 fpm. Time to climb to 5,000 ft is 4.5 min.

In the air the Hughes 269A shows good handling qualities. Directional stability is enhanced by a dorsal fin on the tail boom and longitudinal control is improved by a stabilizer. The most interesting aspect of which the pilot has found, the machine requires constant attention to maintain precise flight path. When a helicopter is maneuvered by a fixed wing aircraft with an air center of gravity displacement in altitude are not damped because position stability is lacking. Control forces are light despite the lack of boost and it appears the 269A could be flown for several hours without even fatigue.

### 269A Advantages

Advantages of the 269A's high power/weight ratio were demonstrated by Hughes' endurance record in major Jon Castellan when the rotor speed was allowed to drop below the minimum of 460 rpm. It was necessary to trade off air altitude to regain the lost rpm. Rotor speed was regained simply by up shifting power. Similarly, when the engine was not fully burning at 1,800 ft, it was necessary to drop the nose to pick up forward speed with a resultant loss of altitude. Collective pitch was reduced and a maximum glide speed of 160 mph was achieved at low altitude. Autorotation landings were accomplished without undue strain because of the helicopter's light disk loading and good controllability.

The wheels, which are attached on the forward part of the skids, can be used for landing takeoffs which can be necessary at high altitudes or at extended gross weights. The machine can be tipped forward and drag speed gained by raising on the skids if a vertical takeoff cannot be made. (The skids are moved to the center of the skids for one man ground handling.)

The air disk skids struts on the landing skids make for greater landing in the case of severe terrain and also allow the helicopter to settle down more gradually if a landing doesn't happen to turn out the way the pilot planned. Ground clearance also is a factor to be considered with the cushioning effect of the skid mounted skids.

Variables, is very good in all directions in the 269A. Of special note is the tested range within to the rear of the rotor which permits backward visibility at that narrow flight may be safely accomplished. The rear window also prevents the tail rotor to be cleared by the pilot prior to starting engine and engaging the rotor.

Hughes 269A is an outgrowth of the YHO-100, a 1955 Army-funded development program which did not go into production but stimulated the light observation helicopter (LOH) program. Conceptual contribution of the helicopter was obtained in April, 1957. Production commenced in July, 1960, and the first completed aircraft rolled off the line in August, 1961. At present the factory stands at 15 helicopters.

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## MANAGEMENT

### Bureau of Standards Seeking Halt To Exodus of Top-Level Scientists

By Philip J. Klass

Washington—National Bureau of Standards is losing some of its top-level scientists to higher paying industry jobs and it is not clear that the number of government scientists, for example for industry, which has focused attention on the problem, according to Dr. Allen V. Vora, director of National Bureau of Standards.

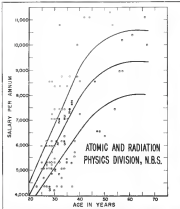
A related problem also stemming from the growing disparity between industry and government salaries, is the increased difficulty of attracting top-level young graduates.

The results of recent Bureau of Standards studies are, for example, the problems facing other govern-

ment laboratories. After leading a group which recently completed a government-wide study of the problem of attracting and retaining scientists, last month release of the report he disclosed to Congress on its conclusions recommended (AWD 11, p. 75).

Increasingly, universities which formerly experienced similar difficulties in attracting and holding competent physical scientists in the face of industry's higher pay scale, appear to have been more successful in boosting salaries from the government. Dr. Vora suggests.

For example, in the past several years the Bureau of Standards has sought to fill a number of director-level openings, which generally are GS-15 civil service grade paying a top salary



SHOCKLEY MERIT INDEX plots salary of individual scientists as a function of age. This statistical data "quartiles" which divide group into four sub-groups of equal size. Figures shown are for National Bureau of Standards division as of October 1964.

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## Supersonic Tow Target Used in Project Highspeed

Supersonic tow target (DPMTC) developed by Del Mar Engineering Laboratories was used in Project Highspeed (AW Oct. 9, p. 21) to evaluate air defense capabilities of Cassirer F-105 and McDonnell F-4H interceptors. RADOP (radio Doppler) target system was towed at Mach 1.5 by both types of interception and furnished radar reflecting and altitudinal characteristics of multi-jet fighters. It also depicted infrared profiles for high-altitude visual tracking. The target is towed externally on the supersonic interception and is controlled by combination radio-beacon mounted on an underway glider.

has been no significant change during the interval, a accurate Merit Index should have accounted contrast.

The analysis shows that 101 action chiefs in the bureau currently have an average Merit Index of 0.33, compared with 0.73 for 50 of the same executives who were employed by Bureau of Standards 10 years ago. This would appear to confirm the trend indicated by

studied at the division chief level. Although a general increase in bureau salaries across the board, the more pressing problem is the ability to raise the salaries for top-level staff.

At present, the bureau has only 15 super grade authorizations which permit salaries greater than the \$15,800 level. That permits only one-third of the division chiefs to receive salaries above

this figure. Yet when industry raises offers to such men, they usually are for \$25,000 or more, Dr. Aron says. During the past year, Department of Commerce received authorizations for five more supergrade positions, of which one went to Bureau of Standards.

Dr. Aron estimates that the Bureau of Standards needs 100 super grade authorizations.

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—Continued

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Leading research organization has positions for experienced engineers in the field of cryogenics and rocket fuels. Positions include: Supervising Engineer, Senior Engineer, Engineer, and Engineer Aide. The organization is currently seeking individuals with a minimum of 5 years experience in the field of cryogenics and rocket fuels. The organization is currently seeking individuals with a minimum of 5 years experience in the field of cryogenics and rocket fuels. The organization is currently seeking individuals with a minimum of 5 years experience in the field of cryogenics and rocket fuels.

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ANALYSTS. Conducting of a closely coordinated network of data acquisition, data processing and data analysis. The network is designed to provide a continuous flow of data to the system. The network is designed to provide a continuous flow of data to the system. The network is designed to provide a continuous flow of data to the system.

In single point defense, the network is designed to provide a continuous flow of data to the system. The network is designed to provide a continuous flow of data to the system. The network is designed to provide a continuous flow of data to the system.



## 412-L STAFF EXPANDING

as program moves ahead in advanced development phase

If you are one of the fast-growing group of scientists and engineers who recognize the unique value of the 412-L staff, we want you to join the staff. The staff is currently seeking individuals with a minimum of 5 years experience in the field of cryogenics and rocket fuels. The staff is currently seeking individuals with a minimum of 5 years experience in the field of cryogenics and rocket fuels. The staff is currently seeking individuals with a minimum of 5 years experience in the field of cryogenics and rocket fuels.

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**SYSTEM EQUIPMENT ANALYSIS**  
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**TECHNICAL WRITERS**  
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Advanced programs for missiles and space vehicles have created the following engineering and scientific disciplines:

- STRUCTURAL ANALYSIS
- HYDRAULICS
- MATERIALS
- SERVO ANALYSIS
- PROPULSION EQUIPMENT

Many other openings exist for engineers (B.S., M.S. or Ph.D.), engineers with minimum of five years' experience). Local area offers opportunity for advanced study for prompt, confidential reply send resume to: Frank B. Cousins, Jr., General Personnel, Department A, Bendix Products Aerospace Division, Bendix Corporation, South Bend 26, Indiana.

**Bendix  
Products  
Aerospace  
Division**



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Write to continue to: Mr. P. W. Chiles, Dept. 44-400,  
DEFENSE SYSTEMS DEPARTMENT in Department of Defense Building  
General Electric, Northern Region Office Building—Spring, New York

**GENERAL ELECTRIC**

TYPICAL ENGINEERING PROJECTS IN PROGRESS

LIQUID ROCKET ENGINES ■ ADVANCED SUPER-SONIC AIRCRAFT POWER PLANTS ■ FUEL CELLS

MAGNETOHYDRODYNAMICS ■ AEROSPACEPLANE PROPULSION SYSTEMS ■ NUCLEAR POWER ■

SOLAR ENERGY CONVERSION ■ ADVANCED CONTROL SYSTEMS ■ CRYOGENICS ■ THERMIONIC AND THERMOELECTRIC CONVERSION ■

ADVANCED MATERIALS DEVELOPMENT ■ SPACE VEHICLE MISSION ANALYSIS ■ TURBOJET'S

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Wide range opportunities exist for the creative engineer at the East Hartford, Connecticut Facility and Florida Research and Development Center of Pratt & Whitney Aircraft.

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**EXCELLENT FACILITIES:** Privately owned facilities provide for the accelerated development/testing of advanced powerplants, advanced rocket motors, high speed turbo jet engines, and full scale rocket components. Further assisting our engineers are comprehensive automatic data acquisition and processing systems, including the latest in computing facilities.

Opportunities exist at all levels of experience for engineers and scientists who want to work as part of a team dedicated to maintaining Pratt & Whitney's position of leadership in the future.

Please submit your resume, including minimum salary requirements, to:

MR. P. R. SMITH: OFFICE 30  
PRATT & WHITNEY AIRCRAFT  
400 MAIN STREET

MR. J. W. MORTON: OFFICE 30  
PRATT & WHITNEY AIRCRAFT  
WEST PALM BEACH  
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All replies will be handled promptly and in complete confidence.

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## Accelerated Program In Advanced Turbine Engine Projects

Creates Need for Scientists and Engineers at  
**ALLISON** where

**Energy Conversion**



**Is Our Business**

Allison—a name long famous for engineering, development and production of outstanding aircraft engines—has accumulated nearly half a century of experience in energy conversion.

The tried and proven T36 and JT1—with their unmatched performance in the versatile Lockheed C-130 Hercules and the McDonnell F3H Demon—are outstanding examples of Allison accomplishments. The T36 also is going into the sub killer, Lockheed P3V, and in the Grumman aerial reconnaissance W2F.

Other recent Allison engine accomplishments include the small, lightweight turbo-shaft engine for the Army's next generation of Light Observation Helicopters.

Perpetuating this distinguished history of achievement, Allison now is deep into advanced turbo-prop engine programs involving a thermal regenerative cycle—and air cooled turbine blades—for optimum fuel economy which increases aircraft range as much as 35%.

Another Allison development in advanced types of air-breathing engines is a by-pass turbo-jet for supersonic aircraft, both military and commercial.

Allison's extensive, overall program includes work on advanced forms of engines, not only for aircraft, but for surface vehicles and industrial power plants as well. Expanded activities in these various fields create requirements NOW for:

- BS, ME or AE with experience. Design of advanced air-breathing engines for aircraft, vehicles and for industrial applications.

- AE or ME with 8 to 10 years experience in propulsion field. Advanced systems studies aimed toward propulsion (air advanced aircraft).

- AE or ME with experience. Design of specific turbomachinery for use in cryogenic field.

- BS, ME or AE with substantial experience. Design from layout stage, advanced version of thermally regenerative turbo-prop and turbo-shaft engines.

- Other openings exist for scientists and engineers qualified in various phases of Allison's advanced energy conversion programs.

Allison's well-equipped facility is located in Indianapolis. And, if you're interested in graduate work, a graduate study program is available at the new Purdue University center in Indianapolis. Also convenient are Butler and Indiana Universities. Send your resume and write for an interview to: Mr. V. A. Rhodes, Professional and Scientific Placement, Dept. 884, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.

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***The Advantage is...***

***HERE***

***How the Phantom II Affects Advanced Base Logistics***

The combat value of an advanced base is directly related to the efficient use of its supplies. Defense planners, seeking to increase the combat potential of advanced bases, quickly come to grips with the economics of logistics. The two-mission Phantom II simplifies the logistic problem because this one airplane provides the capability for not only air defense, but also for long range air-to-ground strikes and troop support. Yet Phantom II support personnel and equipment requirements are no greater than for other fighters with single mission capability.

The Phantom II can effectively deliver

Sparrow III and Sidewinder missiles against air-to-air targets in addition to a full range of ground strike "iron" bombs and nuclear stores. Simply varying the armament of the Phantom II fits the advanced base to shifting combat situations in minutes, in any kind of weather, day or night.

This two-engine, two-man, Mach 2+ fighter holds world speed records for 500, 100, and 3 kilometers, has crossed the continent in 170 minutes, reached an altitude of 98,560 feet and has a dash speed in excess of 1500 mph. Combat equipped, the Phantom II operates easily from existing 5000 foot runways.



***MCDONNELL***

*Phantom II Fighter and Attack Aircraft •  
Mercury, Asset and Aeroballistic Spacecraft • Talos and Typhon Missile Airframes and Engines  
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